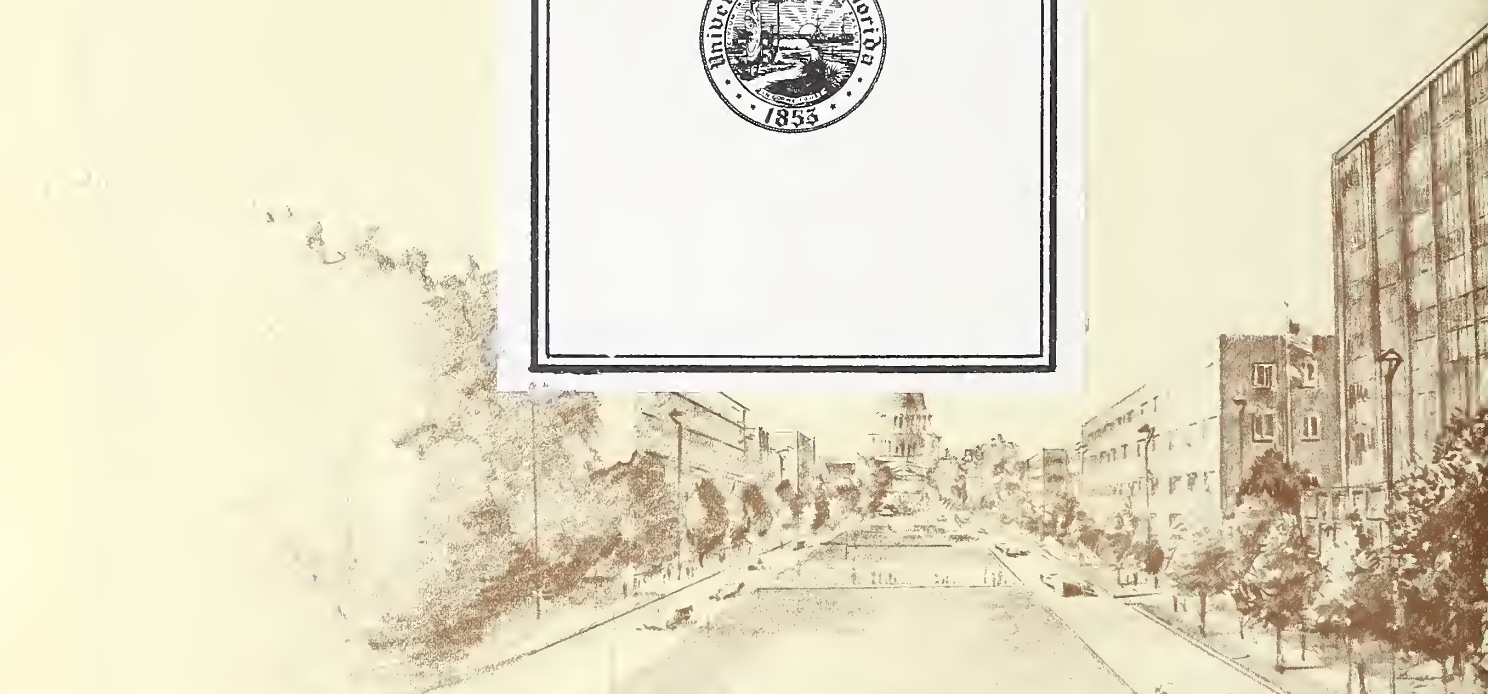
Commitment to Excellence

A HISTORY OF
THE SACRAMENTO DISTRICT
U.S. ARMY CORPS OF ENGINEERS

1929 - 1973

U.S. ARMY ENGINEER DISTRICT, SACRAMENTO, CALIFORNIA

1976



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A HISTORY OF THE SACRAMENTO DISTRICT U.S. ARMY CORPS OF ENGINEERS 1929 - 1973

By
Joseph J. Hagwood, Jr.

U.S. ARMY ENGINEER DISTRICT,
SACRAMENTO 1976

THE AUTHOR

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FOREWORD

The birth certificate of the Sacramento District is dated 7 October 1929, but the organization, under other names, performed for many years prior to that date.

At the time of its formal activation, the Sacramento District's boundaries were entirely within the State of California, and extended from the Sierra Nevada on the east to the coast ranges on the west, and from the Cascade range and the Oregon boundary on the north to the Tehachapi Mountains on the south.

Today, the infant District has grown in size to become the second largest in the Corps, with design, construction, and real estate responsibilities, both civil and military, in all or parts of eleven western states.

The compelling story of its growth, both before and after its official establishment, is graphically detailed in this history, often in the very words of the dedicated Corps employees who contributed to its present preeminence.

We present it for your consideration and enjoyment, and invite you to share with the thousands of Sacramento District employees and officers, past and present, the pride they take in their achievements.

F.G. ROCKWELL, Jr.
Colonel, CE
District Engineer

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PREFACE

Just across the Charles River from Boston, there was a pleasant green mount called Breed's Hill. Just to the west was Bunker Hill. For some obscure reason, historians have recorded the battle that took place on Breed's Hill as the "Battle of Bunker Hill". On the night of June 16, 1775, only thirty-six hours since Washington was elected commander-in-chief of the patriot army, a group of farmer-soldiers crept along the dusty roads from Cambridge, and under cover of darkness encamped on Breed's Hill. Directed by Major General Richard Gridley, Chief of Engineers, they swarmed about under the cold stars, sweating, and whispering orders. Through the long night they toiled, putting up a redoubt of fresh earth and sod against a rail fence, and fortifying it with stones. By first light, the parapet was as high as a man's chin.

With the light came the Redcoats, commanded by General Howe. Being a pleasant summer's day, the residents of Boston climbed to the tops of their houses to watch the novel and interesting scene unfolding across the river. Some brought food and wine. They felt as if they were going to the theater; nobody was really serious; nobody was going to die; the whole thing was just so much play-acting. Never in recorded history were spectators able to observe a battle at such close range. The British, wanting to make a noble, straightforward frontal attack, and to demonstrate the uselessness of the entrenchments, rolled their drums and advanced toward the breast-works in "long straight lines like rows of geraniums."

When the British were within fifteen yards of the entrenchments, heads and rifles suddenly appeared over the parapet, and there was a quick burst of fire and smoke. Scorching volleys of slag and horseshoe nails tore open the red-coated bellies. The British soldiers went down "like milkweeds before a scythe". They retreated in glassy-eyed horror. General Howe tried to pull his men together. He told them, "I shall not desire any one of you to advance one

step beyond where I am at the head of your line." Brave but stupid, he lead them into the jaws of death again. Once again they were torn to shreds by the patriots' muskets.

By then the farmers were all but out of ammunition. If they had retreated they might have saved themselves for another day. They didn't. Some left — the majority stayed and died in the third and final charge of the day. Half-dressed farm boys and old men hurled themselves against a sea of bayonets only to die with British rifleballs crashing through their brains. When the smoke cleared, more than a thousand soldiers of the King were laid out on the soft green grass, with blood oozing from their torn, lifeless bodies. In this first terrible contest, the Americans killed the enemy at the rate of three to one.

That's how they began — the Corps of Engineers — conceived in haste and baptized by fire. Just a day before the battle, the Continental Congress passed a resolution providing for a Chief Engineer of the Grand Army. However, the resolution was not precisely worded, and some confusion resulted. To put things right, the Congress enacted a more detailed resolution on March 11, 1779. In part it read, "Resolved, that the engineers in the service of the United States shall be formed in a corps and styled the 'Corps of Engineers', and shall take rank and enjoy the same rights, honors, and privileges with the other troops of the Continental establishment."

Down through the years, the Corps has taken part in every military action of the United States, from Breed's Hill to Cam Ranh Bay. In addition, it has continually contributed to the growth of our nation through its civil works programs. Corps of Engineers' officers have surveyed land, cut roads through the wilderness, laid out railroads, protected early settlers, improved rivers and harbors, designed and constructed flood-control works, built hydroelectric dams, erected public buildings and managed National park areas. It's been a long proud history, spanning two centuries. The men and women of the Sacramento District have contributed greatly to the organization's accomplishments and are justifiably proud of their excellent work.

When asked their feelings about the District, retired employees responded in the following manner:

Robert R. Morley — With the Corps 1929-1968; Sacramento District 1944-1968

> In retrospect, after completing forty years of service on many different types of projects in many sections of the United States, I am convinced that the Corps of Engineers is the greatest engineering organization in the world and I am proud to have had a small part in its activities.

Ronald (Tommy) Thompson — With the Sacramento District 1930-1966 (35 years). Although he may not have known it at the time, when Tommy came to the District from the College of the Pacific in Stockton, he came to stay. He began in the days when men learned the river by living on it, and by trudging miles through thick brush on its banks. With hatchet in hand, he shaped and pounded stakes to mark out the now improved levee system that serves the Valley. That was back in 1930. He started out as a surveyman — known today as an Engineering Aide — on the Stockton Deep Water Channel, and worked his way up until at his retirement in December, 1966, he was Chief of the Operations Branch in the Sacramento District.

He recalls:

> The Corps of Engineers is a sound organization and one I was fortunate to have been associated with about half my natural life and substantially all my working life. When necessary, the people in the Corps have the ability to cut through paper tigers to accomplish things, i.e., during World War II, when the Sacramento District went into war construction with a hundred or so employees, peaked at about 3,000 and performed an amazing amount of work in a relatively short time.
>
> I believe the challenges being presented by current trends in public thinking can be met by the Corps and that sound logical courses of action can be developed to get the best possible results for the present and future good of the country.

Frank L. Waddock — With the Sacramento District 1932-1967 (35 years)

> I believe the Corps is highly capable of successfully and expeditiously achieving completion of projects assigned to it — both then and now.

James Coombs — With the Sacramento District 1935-1966 (31 years)

> I always felt that the Corps of Engineers, particularly the Sacramento District, was an outstanding engineering organization. I have always been very proud to be a part of that organization. In retrospect, my opinions have not changed and I believe that the good work that the Sacramento District has accomplished since its inception in the late twenties has led to the recent take over, by the District, of all the Military Work on the West Coast. I do not believe that this work would have been given to us unless some higher up had great confidence in our work.

Mrs. Marion Morton — 26 years with the District. Mrs. Marion Morton expressed her own feelings, and those of many others, when she stated:

> Always, during my career, I have felt most fortunate and proud to find myself in this organization. I felt myself part of a widespread and important and respected activity. I felt conscious of the privilege of working with so many admirable people. My feeling has not changed.
>
> May I add one reminiscent thought. I fully realize this is a different age, and the Corps and its works have increased many times over; however — I can't help remembering those earlier days when we were smaller; not so highly organized; and we gladly did whatever needed to be done; our Orders and Regulations was the size of a desk dictionary, 10 chapters.

When one visits the modern office complex now housing the Sacramento District offices, it's difficult to visualize those quieter, simpler days; when instead of a thousand employees, the Sacramento District employed only a handful of men and occupied a small room in a local hotel.

The first "District office," established in the City of Sacramento, comprised a few hundred square feet in the Clunie Hotel located at 8th and K Streets. That was more than half a century ago. This small sub-office of the San Francisco District was home to the survey parties, snag boat crews and other "River Rats" who made the early attempts to improve navigation on the Sacramento River.

OWEN G. STANLEY

OWEN G. STANLEY
SOUTH PACIFIC DIVISION, 1906 - 1952

Born 21 September 1882 at Humeston, Iowa. AB in civil engineering, Leland Stanford Junior University, in 1906. Entered federal civil service as a draftsman for the California Debris Commission at San Francisco in July 1906. He continued with the Corps when the CDC's organization took over District work as the third San Francisco Engineer District. (This later became the second San Francisco Engineer District and, in 1929, the Sacramento Engineer District). Worked as inspector, surveyor, civil engineer and, in 1919, became Senior Engineer of the Sacramento District with general supervisory authority over all office and field engineering design and operations. Served there until a standard district organization was adopted by the Corps around 1936 which set up a separate division to prosecute engineering investigations and design. He remained in the Sacramento District as Chief, Operations Division, until 1939 when he transferred to the South Pacific Division Engineer's Office, San Francisco. He served there as Chief, Flood Control and Debris Control Section, Assistant Chief and Chief, Engineering Division, and finally special assistant to the Division Engineer, for civil works. He prepared and presented a paper, "Possibility of Increasing Navigability of the Sacramento River by Construction of Locks and Dams and the Beneficial Effects of Same Upon Irrigation" before the Sacramento River Problems Conference in January 1924. He represented the Corps on the Central Valleys Project Studies conducted by the Bureau of Reclamation in 1944. Thirteen committees covered separate aspects of the project; Stanley chaired the "Navigation" committee, was a member of several others. He participated in the U.N. Scientific Conference on the Conservation and Utilization of Resources in 1949, presenting a paper entitled "Sedimentation", which he prepared jointly with Mr. E.W. Lane, Bureau of Reclamation. Mr. Stanley retired as special assistant in 1952 at the age of 70 after more than 46 years of continuous professional service to the Corps of Engineers, over 33 of which were devoted to Sacramento District projects. Mr. Stanley died in February 1966 at the age of 83.

After utilizing space in the Clunie Hotel for about a decade, the "District Office" was moved across the street to the Nicolaus Building around 1924. By this time Owen Stanley had made many contributions to navigation and flood control in the Central Valley, and Henry Rich was celebrating his 14th year with the Corps of Engineers.

In 1927, operations were moved up-town a few blocks to the Plaza Building on 10th Street. Then, two years later, the first official District Office of the newly established Sacramento District was set up in the California Fruit Building at 4th and J streets. The relatively few offices housed in the Fruit Building served as headquarters from 1929 through the first half of the Great Depression.

The larger staff needed to prepare the flood control studies, plan the debris dams and complete the expanded work load of the Depression years, required additional working space. So, in 1935, the District Office was moved to the Old Post Office building at 9th and I Streets. During the latter part of the thirties, the District continued to grow, primarily because of the added work force needed to complete the famous "308" studies.

The responsibilities of war-time construction meant yet another move for District personnel. New office space was secured in the Wright Building in December, 1941. The Sacramento District was headquartered there until its

most recent move, in 1961, to the Federal Building and U.S. Courthouse located at 650 Capitol Mall. In addition to those buildings that have been "home" to the District Office, many other buildings have accommodated various divisions and branches of the main office. The Sacramento Signal Depot, the McClatchy Building, the Brinley Building, the Scampini Building, Bryte Yard and various other sites throughout the Sacramento area have been utilized to house elements of the District.

For many years, the *unofficial* District Office was "Frank Fat's", a downtown restaurant. Used often as a place for social gatherings of Corps people, it was also the place where knotty problems were solved. Many seasoned veterans recall the days when small groups of men would go down the back stairs of the Wright Building, through the back door of "Frank Fat's," past the pots and pans in the kitchen, and settle down over a "mild libation" to hammer out, informally, that which didn't lend itself to polite discussion.

Not only the times and places, but the men and women directing the District in years past, have set the mood, established the climate, and defined the procedures of a given era. Prior to the official establishment of the District in 1929, men like Owen Stanley, and Division Engineers in San Francisco such as Jackson and Grant set the pace and directed the activities of the Corps of Engineers in the Central Valley. Since that time however, the Sacramento District has been directed by a wide variety of competent, local personalities: Henry Rich, a diamond in the rough, could always be counted upon when the going got tough; Henderson McGee, known as the professor, who somehow managed, in a calm and quiet way, to bring order to a chaotic situation; Amalio Gomez, O. Haven Hart and Frank Kochis, professional engineers who could cut through the bureaucratic clutter and got the job done.

The miliary leadership of the District has always been brilliant. Besides being capable officers, they often displayed the warmer, human sides of their natures. During the war years, Colonel R.C. Hunter was known as a man who could accomplish any mission, "no matter what". On the other hand he is remembered as being an extremely fair man, well liked by the civilian employees. Colonel Lester F. Rhodes is remembered as being an excellent bridge player. He was followed by Colonel Joseph Gorlinski, often called the "Count" because of his truly aristocractic manners. Colonel Alvin D. Wilder, it may be recalled, was a natural poet and song writer, who gave the District the beautiful ballad entitled "Frankie, Frankie Kochis, King of the Two Top Floors". (Sung to the tune of Davy Crockett.) Many District employees remembered Colonel Robert Mathe as being a loud singer and a terrible guitar player, with the ability to make friends easily. Colonel Crawford Young is said to have been a born fighter, a good man to have on your team. It was felt that he acquired his excellent characteristics while playing football at West Point. He was a blocking back, which allowed his teammates to score. He is also remembered as a pretty fair golfer.

The Sacramento District has been extremely fortunate in having been served by exemplary leaderships, both military and civilian. But it must be remembered that the District functions and accomplishes its missions through cooperation and teamwork. The excellent reputation gained and held by the Sacramento District is the result of many people in small elements of the organizational structure who put their total effort into their work. It is a team

enterprise from start to finish.

The preparation of the history of the Sacramento District was made possible by this same kind of team spirit. General George B. Fink, South Pacific Division Engineer, Colonel Frederick G. Rockwell, District Engineer, and Colonel James C. Donovan, immediate past District Engineer, have demonstrated complete cooperation in this project. Many civilian employees, presently employed or retired, have also given freely of their time and energy to insure the successful completion of the history. Listed in alphabetical order, they are as follows:

District Employees:

Don Adams, Roan Aicklen, Laura Asay, Helen Bennett, Carl Greenstein, Pat Guthrie, Lynn Henson, Les Houde, Wanda Hunt, Oscar Johnson, Marv Le Fohn, John Mathews, Lee Mull, Mildred Oulicky, G.W. (Bud) Probasco, George Rivera, Jack Ross, Bob Simmons and George Weddell.

Retired Employees:

Ray Barsdale, Jim Coombs, Claude A.J. English, Amalio Gomez, Clyde Gorman, O. Haven Hart, Sam Kahiona, Frank Kochis, Henderson McGee, Robert Morley, Marion Morton, Henry Rich and Ronald Thompson.

CHAPTER I
HISTORICAL PERSPECTIVE

The Sacramento District, United States Army Corps of Engineers, while not yet a half-century old, enjoys a heritage deeply rooted in the history of the West. For more than a hundred years engineering officers have been engaged in military and civil works projects throughout the region presently within the perimeter of the Sacramento District.

Prior to the war with Mexico, John C. Fremont, a Corps of Engineers officer, explored and publicized much of the area. Of Fremont's five expeditions, the second and third were most significant. During the second, in 1843 and 1844, he came west by way of Bent's Fort, Colorado, South Pass, Wyoming, and the Oregon Trail to the Dalles; then south along the eastern side of the Cascades and the Sierra Nevada, and then across the Sierra in the dead of winter by way of Carson Pass. He and his men lingered at Sutter's Fort for a month to regain their strength before continuing their journey. After securing fresh horses and supplies they headed south through the San Joaquin Valley, crossed Tehachapi Pass, followed the Old Spanish Trail into southern Utah, and returned to the States by way of the Sevier River, Utah Lake, the headwaters of the Grand and Arkansas Rivers and finally Bent's Fort.

The spring of 1845 found "The Pathfinder" on the trail again with a contingent of sixty-two men. He proceeded to Salt Lake and then made his way to Walker Lake by way of the Humboldt Valley. With winter fast approaching, he decided to take fifteen of his men over the mountains to Sutter's Fort, and ordered Joseph Walker to lead the main party across the Sierra by way of Walker Pass. Failing to find their previously determined rendezvous point, Fremont went on to Yerba Buena (San Francisco) and Monterey and eventually joined his main force in the Santa Clara Valley. Fremont obtained permission from the Mexican authorities to remain in California for the rest of the winter on the condition that he and his men remove themselves from the coastal area. With destiny stirring in his soul, he stayed on at Monterey, ignored the Mexican authorities and eventually became deeply embroiled in

LIEUTENANT JOHN C. FREMONT

Western troubles, which eventually tinctured his celebrated career. And while enthusiastic biographers came to pay excessive homage to the once obscure lieutenant of topographical engineers, he nonetheless established the Corps of Engineers quite firmly within the territory, history and mythology of the west.

Once the question of who owned California, and much of the Southwest, was decided, increased numbers of military engineers were stationed in the West. In 1846 Lieutenant H.W. Halleck (later General-in-Chief of the Armies of the United States, 1862-64) was assigned as engineer for military operations on the Pacific Coast. Arriving in San Francisco in 1847, he was appointed Secretary of State for California as part of the military government. In addition he was charged with the responsibility of carrying out engineering studies for the defense needs of the region.

The next year the Pacific Coast Board of En-

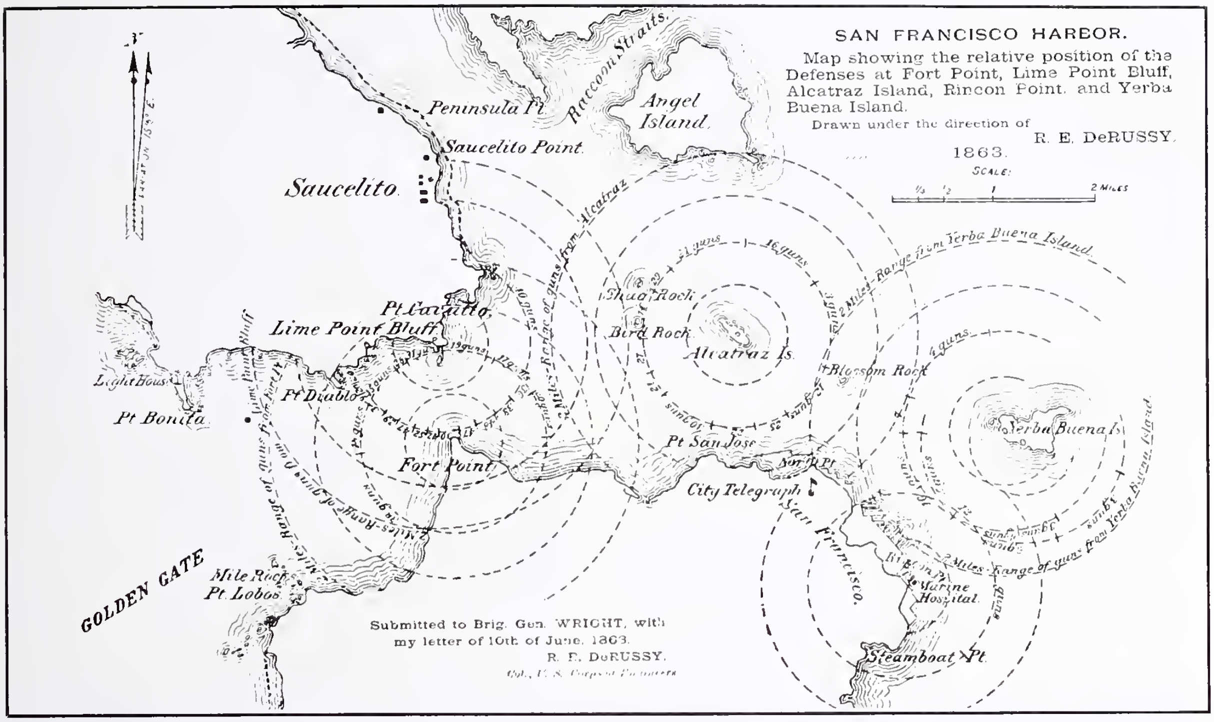
gineers was created to survey the coastal area to focus particular attention on fortification of San Francisco Bay. From the mid 1850s until the outbreak of the Civil War, Army engineers were occupied in building posts and fortifications to protect the area in the event of attack. Alcatraz and Angel Islands were fortified. Work was also begun on Forts Point, Winfield Scott, and Mason while batteries were placed on Lime Point.

Throughout the .decade preceding the outbreak of civil war the heterogeneous population that clung to the shore of the bay busied itself with the feverish quest for gold and with speculation in commodities and real estate. When news of the war arrived in California, the citizens rallied to the Union cause and contributed heavily of men, money and materials. Some sixteen thousand troops were raised in California during the war. In the main they served to free regular seasoned troops for the decisive campaigns of the Union Army, their chief service to the Nation being the defense of the vast western frontier.

In addition to their strictly military role, engineer officers participated in the surveys and construction of the first continental railroad. Without the loan of such trained personnel, completion of the western railroads may well have been delayed half a century by the dearth in America of qualified engineers.

Eventually engineering explorations in the far west became focused on two basic objectives: the location of suitable passes through the Sierra Nevada and Coast Ranges and the determination of a route that would connect California with the Northwest. In the summer of 1853 Lieutenant R.S. Williamson led an ex-

FORT POINT, CA 1869
Photos from 6th U.S. Army collection

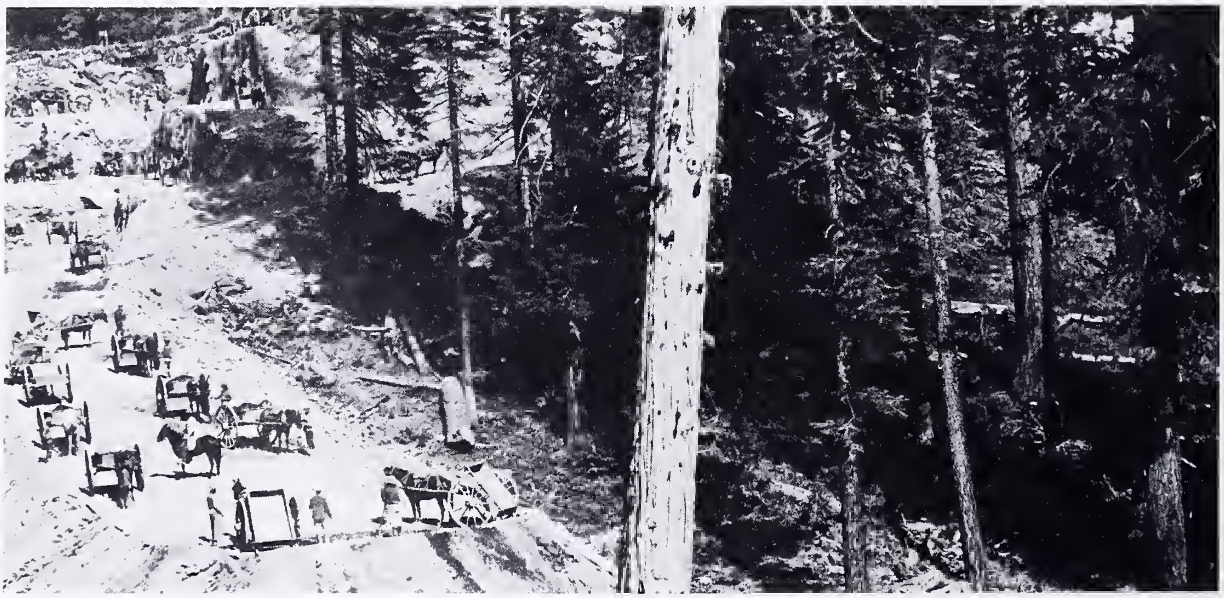

SAN FRANCISCO HARBOR.
Map showing the relative position of the Defenses at Fort Point, Lime Point Bluff, Alcatraz Island, Rincon Point, and Yerba Buena Island.
Drawn under the direction of
R. E. DeRUSSY.
1863.
SCALE:
2 MILES
Peninsula Pt.
Raccoon Straits
Angel Island.
Saucelito Point.
Saucelito.
Pt. Cavallo.
Lime Point Bluff
Light House
Pt. Bonita
Pt. Diablo
Fort Point
Shag Rock
Bird Rock
Alcatraz Is.
Blossom Rock
Yerba Buena Is.
Pt. San Jose
North Pt.
City Telegraph
San Francisco.
Marine Hospital.
Steamboat Pt.
Mile Rock
Pt. Lobos
GOLDEN GATE
Range of guns from Yerba Buena Island.
2 Miles Range of guns from Yerba Buena Island.
Submitted to Brig. Gen. WRIGHT, with my letter of 10th of June, 1863.
R. E. DeRUSSY.

pedition south from Benicia (then the state capital) into the San Joaquin and Tulare valleys for the purpose of exploring all of the passes in the southern Sierra.

Williamson, in the company of Lieutenant H.L. Abbott of the Topographical Corps, led another survey party north through the Sacramento Valley during the spring of 1855. When completed the surveys and explorations indicated that two possible routes existed between California and the Northwest settlements, one east and another west of the Cascades. The only real obstacles discovered were a series of ridges between the Sacramento and Des Chutes valleys which could be readily circumvented by means of passes that turned their flanks in either direction.

As an added bonus to the valuable railroad data collected, the Williamson-Abbott surveys disclosed new agricultural possibilities in the little known country between California and the Columbia River. Moreover, they painted a much more favorable picture of western climate and resources for federal policy makers than those who had earlier labeled the region, "The Great American Desert."

Another area of concern to the engineering officers stationed on the coast, and to the civilian population as well, was the lack of roads. Western congressmen, led by John B. Weller of California, placed the blame on the Army Corps of Engineers for not providing proper transport facilities. Weller told Congress that the citizens of California demanded that a wagon road be pushed through from Missouri to California to aid immigration, serve the needs of defense and speed postal service. At the same time a colossal petition signed by 75,000 Californians was presented to the national lawmakers asking that a military wagon road be constructed to California by way of Salt Lake. These efforts led to appropriations totaling half a million dollars for development of two routes, one north and one south,



CHINESE LABORERS WORKING WITH PICKS AND SHOVELS AND DUMP CARTS BUILDING THE EMBANKMENT AND MAKING A CUT (MATERIAL FROM WHICH WAS USED TO FILL THE BANK) AT SAILOR'S SPUR, 80 MILES FROM SACRAMENTO IN 1866. IN THE BACKGROUND IS AN EXCELLENT EXAMPLE OF CENTRAL PACIFIC'S SHELF-GRADING METHOD IN WHICH DIFFERENT TEAMS OF MEN WORKED ON DIFFERENT LEVELS TO SPEED THE WORK TO COMPLETION.
(Southern Pacific Photo by Alfred A. Hart, official Central Pacific Photographer, Sacramento.)

from the midwest to the coast. And hot on the heels of the federal road appropriation came another measure most heartening to the advocates of overland transport. The Postmaster General was authorized to contract for six years at $600,000 a year for semiweekly postal service on a 25-day schedule from the Mississippi to San Francisco.

As Secretary of War in Pierce's cabinet, Jefferson Davis felt that if the Army was to be an effective force on the frontier, the difficult problems of supply must be solved. More and better roads would certainly help. Davis even went so far as to experiment with camels to facilitate the movement of men and supplies.

In the summer of 1855 Davis established the Pacific Wagon Road Office at San Francisco and appointed Major Hartman Bache of the Corps of Engineers to supervise activities. For the next several years, Army engineers constructed a rather extensive network of wagon roads throughout California and the West. When trying to secure funds for construction, the roads were justified primarily in military terms. Yet when built, they incorporated features not required strictly for military purposes. In the final analysis, they proved to be of tremendous benefit to both the civilian and military population of the far West. With the beginning of civil war, the troops involved in road construction were ordered east, and any project not deemed essential to the war effort was halted.

Hostilities ended and the states bound east to west by double band of iron rails; the country's energies were redirected toward economic pursuits. Favorable governmental policies, boundless natural resources, a tremendous influx of people, a vigorous business community and a good bit of advertising helped transform California and the West into one of the most valuable pieces of real estate on the globe.

Throughout the final quarter of the last century military activities of Corps of Engineers assigned to the Pacific coast fell into two categories: coastal defense and final subjugation of the Indians. At century's end, in the spring of 1898, the war with Spain erupted,

UNITED STATES ARMY CORPS OF ENGINEERS SURVEY PARTY AT CACHE VALLEY, UTAH, 1871.

ARMY ENGINEERS CONSTRUCT PONTOON BRIDGE ACROSS JAMES RIVER, VIRGINIA, DURING CIVIL WAR PERIOD.

making San Francisco one of the busiest ports in the nation. Ships, men and supplies went forth to assist Colonel Roosevelt and the Rough Riders capture San Juan Hill. By June 30, the first troops sailing from San Francisco for the Philippines had arrived in Manila Bay to support Admiral Dewey.

It is important to note that until about the turn of the century, Corps of Engineers activities on the Pacific coast, both military and civil, were directed and supervised by the ranking engineering officer at San Francisco. This had been the case since 1866 when Major R.S. Williamson was appointed District Engineer for Rivers and Harbors of the Pacific Coast.

Eventually military defense for the area would become the responsibility of the regular army, with military construction being handled by the Quartermaster Corps. By 1908 the area that was later designated the Sacramento District was almost evenly divided between the First and Second San Francisco Districts. Moreover, from 1908 until 1941, the Sacramento District, regardless of nomenclature, performed a civil mission only.

It is not a great exaggeration to assert that the Sacramento District's civil works responsibilities began with Marshall's discovery of gold during the winter of 1848. For, the unique early development of the District was practically interwoven with the problems resulting from mining activities. Hence, if one is to follow the events that led to the formation of the District in 1929, one must be cognizant of the circumstances and ramifications of gold extraction within California.

During the very early days of mining, requirements for gold recovery were quite simple. Whatever a man could bring with him, or manufacture at or near his claim, proved adequate to secure the easily worked alluvial deposits. But as the sands and gravels of the river beds were worked to exhaustion, the miners raised their horizons from the bottoms of metal pans and wooden boxes to the sides of the lofty canyons of the Sierra Nevada in search of the treasure's source. Here they en-

countered ancient stream channels filled with gold-bearing sand, gravel and rock. These tertiary deposits, so called because of the geological division of time during which they were formed, proved to be one of the richest sources of gold in the state. Profitable mining of these ancient channels, however, was dependent upon the low-cost removal of overburden which blanketed the valuable gravels.

Anthony Chabot devised a system to uncover the gold that was as economical as it was simple. During the spring of 1852 he constructed a set of wooden penstocks near his claim on Buckeye Hill above Nevada City. A canvas hose was attached to the penstocks, and the water that poured forth from this ingenious device was directed over the soil to be mined. Chabot washed the overburden as well as the gold-laden gravels into the ditch which had been excavated in the bedrock. Periodically he would shut off the flow and "clean up" the gold which had collected in the natural sluice. Hydraulic mining had been born!

Once the initial concept was implemented, methods and materials improved at breakneck speed. Wooden nozzles gave way to iron and steel, while sheet iron pressure pipe was substituted for rawhide and canvas hoses. Large amounts of available water were the key to the process. To meet the demand, extensive water systems were built until they cloaked the western Sierra in a web of flumes, canals and pipelines. At its peak, hydraulic mining utilized some 600 thousand acre feet of water per year.

From its simple beginning, the hydraulic mining industry grew to gigantic proportions. It carried on its operations wholly without regard to what happened to the silt, sand and gravel after the gold was removed. Large-scale hydraulicking, while it produced great quantities of gold, also produced stupendous quantities of tailing, which became trapped in the river canyons of the mountains. During the early 1860s torrential rainstorms washed a portion of the stored-up debris out of the mountains and down onto the valley floor.

Immediately a cry of protest arose from the farmers as the polluted water, "too thick to drink and too thin to plow," swept over their unprotected farms. By the early 1880s five hundred mines, representing an aggregate capital investment of $100,000,000, were sending an avalanche of debris down the rivers that all too often claimed fertile agricultural land as its final resting place. It is estimated that between 1852 and 1909 some one-and-one-half billion cubic yards of earth, rocks and sand were washed into the streams from the Sierra to the sea.

POWERFUL "WATER CANNONS" SUCH AS THIS RIPPED THE MOUNTAINS APART, AND SENT DEBRIS INTO THE RIVERS.
(Army Corps of Engineers [C.E.] *Photo)*

Valley residents rose up in anger because each small rise in the water level meant a costly flood. Through the sixties, seventies and into the eighties, the atmosphere of hostility between valley farmers and mountain miners, caused by the constant creeping of the glaciers of debris, grew even more tense and bitter.

Appeal to the legislature and the courts by the farmers was inevitable, and after many years of frustration and near victories, the agricultural interests prevailed. Finally, the

SMALL, PRIVATELY CONSTRUCTED, DEBRIS DAMS SUCH AS THESE PROVED INEFFECTUAL IN THE FIGHT TO HOLD BACK THE FLOOD OF DEBRIS THAT WAS BEING WASHED INTO THE RIVERS OF THE WESTERN SIERRA.
C.E. Photos

"giant was crushed without honor in its own country!" The major blow fell during 1884 in the form of the sweeping Sawyer Decision which enjoined the placing of mining debris in water courses which were tributary to navigable streams. Eventually the giant monitors were silenced and the flumes, canals and reservoirs rotted away; most of the towns that had been nourished by the industry died.

Judge Sawyer's decision did not outlaw the hydraulic process, such mining being quite legal if only the operator kept the refuse of his operation out of the drainage system adjacent to his claim. As viewed at the time, however, fulfilling such a requirement seemed impossible. Bootleg mining continued for a while, but it was merely a matter of time before the last nozzle was shut off.

The Sierra, it seems, breeds a stubborn lot, for no sooner had the courts suffocated the industry than miners initiated efforts toward rehabilitation. Joined by those concerned with river reclamation and flood control, they were able to secure passage of a memorial to Congress in 1887 that asked for a complete federal investigation of both the debris problem and the possibilities of river reclamation. We must remember that even though hydraulicking had been shut down, the debris problem grew worse each year, and it would take yet another decade before the river beds ceased rising and began falling.

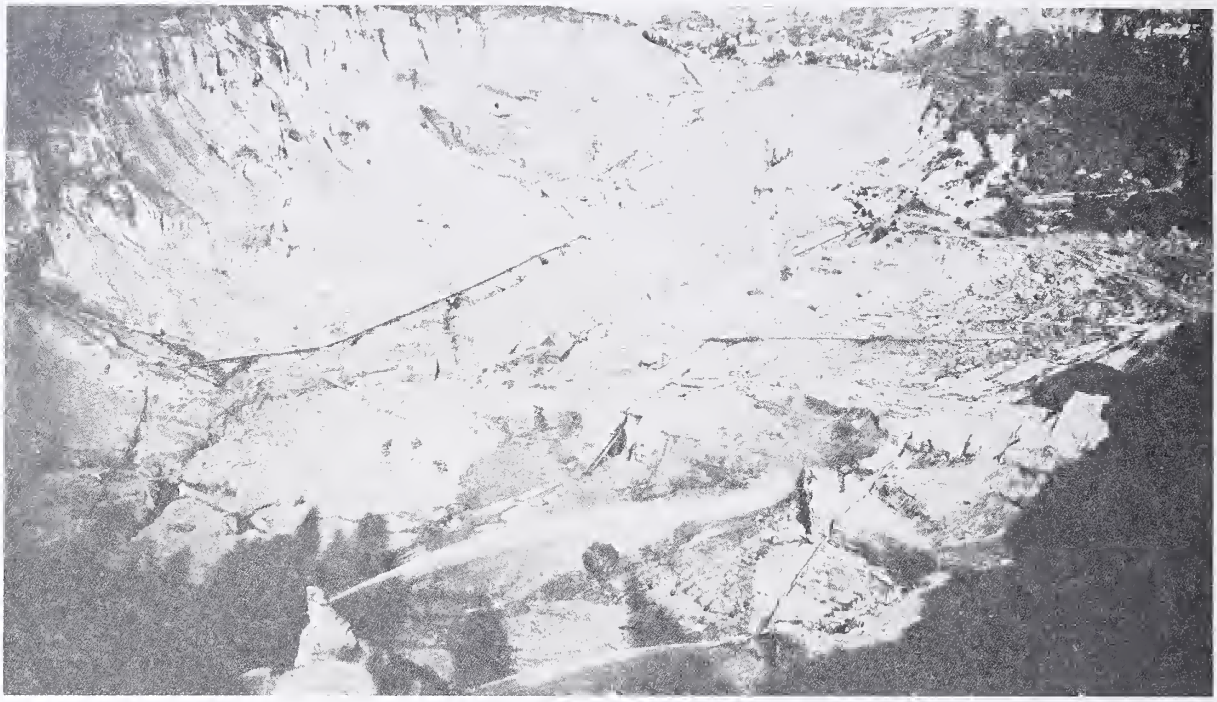
In January of 1888 Congressman Biggs from Gridley, Butte County, introduced in Congress a bill that encompassed both concepts. The valley sought funds for reclamation, not new investigations of the debris problem, and protested the Biggs bill. On the other hand, the miners strongly supported the bill and forwarded petitions to Congress endorsing the proposed legislation. Finally in September of 1888 the bill was passed, with a hundred thousand dollars being appropriate to provide for a commission of three Corps of Engineers officers to study the situation, and if possible to submit a plan whereby both mining could resume and reclamation of the rivers could get underway.

The Commission investigated the problems for more than a year, then published its findings in February of 1891. The engineers believed that by constructing large, permanent, stone barriers across the major tributaries of the Sacramento River, debris could be restrained. Further, they recommended the building of brush wing dams in the river channels to force them to scour out the debris deposited by earlier mining activities.

Shortly thereafter, a bill incorporating these recommendations was introduced in the House of Representatives by the recently-elected Congressman from Amador County, Anthony Caminetti. In the spring of 1893, President Harrison signed the Caminetti Act into law.

As in the case with any compromise, neither side was completely satisfied with the Caminetti Act. The author of the legislation suggested that "the people of California do not yet realize what a tremendous advantage this bill is going to be to them. It is usually spoken of as a measure for the benefit of miners, but its provisions for the improvement of the rivers will be found to be still more important."

His statement has proved to be valid. No amount of legislation would ever revive the hydraulic mining industry. On the other hand, river management, flood control, reclamation and navigation projects of every variety, with the exception of levees, throughout the Sacramento District had their beginnings with the Caminetti Act.



PHOTOS SHOWING EARLY HYDRAULIC MINING ACTIVITIES AT "MALAKOFF DIGGINGS" IN THE UPPER WATERSHED OF YUBA RIVER. THIS SITE IS NOW PART OF A 7,000-ACRE STATE PARK.

CHAPTER II THE CALIFORNIA DEBRIS COMMISSION AND RIVER RECLAMATION

The interest of navigation, the problem of flood control, and the control and disposition of mine debris in and along the Sacramento and Feather Rivers and their tributaries, including also the San Joaquin River and its tributaries, are all inseparably connected. These matters are in (The) charge of the California Debris Commission.

Quote from Annual Report of the Chief of Engineers-1914

The Caminetti Act created a commission, consisting of three officers from the United States Army Corps of Engineers, known as the California Debris Commission. On June 8, 1893, the Commission, with Colonel C.H. Mendell as president, met in San Francisco to assume its official duties. The officers were "empowered and required to adopt plans for improving the navigation of the Sacramento and San Joaquin Rivers, project and construct works for impounding detritus and preventing the deterioration of the rivers from the deposit of hydraulic mining and other debris, and devise means and issue permits for resuming and carrying on hydraulic mining operations under conditions that will not injure other interests in the State."

Over the years nearly three thousand permits have been issued by the Commission to persons wishing to mine by the hydraulic method. It proved impossible, however, for private individuals to build and maintain water delivery systems and restraining works massive enough to enable industry to accomplish even moderate rehabilitation. Hydraulic mining was, and remained "as prostrate as a rural graveyard." Many years later, during the depths of the "Great Depression," a handful of militant visionaries convinced the federal government to become a party to a scheme that they believed would resurrect the fallen giant — hydraulic mining. These dedicated, well-meaning romantics — characterized by small mountain businessmen, unemployed lumbermen, laborers, dirt farmers blown out of the dust bowl and weekend gold-seekers — secured passage of legislation which committed the California Debris Commission to the construction of high dams, similar in concept to those proposed in 1891, for the purpose of restraining hydraulic mining debris.

During the late 1930s and early 1940s two such dams were constructed, but to date the amount of hydraulic mining accomplished within the District since completion of the dams has remained so meager as to be hardly measurable. By the time these concrete plugs were placed in the streams of the western Sierra, conditions favorable to rehabilitation were literally nonexistent. As we will examine this topic further in the next chapter, let us now turn our attention to the matter of river reclamation and flood control.

During the latter part of the nineteenth century and the early decades of the twentieth, swift, handsome and commodious sternwheelers regularly plied the inland waters between San Francisco and Sacramento. The river's edge near Sacramento was lined with docks, piers and wharves to accommodate waterborne traffic. The *Helen Hensley*, *Pioneer No. 2*, *Alice*, *Capital*, *New World*, and *Julia* were among the scores of freight and passenger vessels that brought goods and passengers to the Capital City. By the turn of the century, upwards of one million tons of freight and three hundred thousand passengers were being carried annually by vessels of all classes. Moreover the distribution of grain, lumber, groceries, fruit, vegetables and merchandise of every description was, to a large extent, dependent on inexpensive water transportation. Lack of sufficient federal funds coupled with obstacles in coordinating monies appropriated by the State of California prevented the Commission from implementing meaningful navigation plans until around the turn of the century. Some survey work, snagging and dredging has been accomplished during the last quarter of the nineteenth century, but never on a scale that would clean the Sacramento and its tributaries of the accumulated muck clogging their channels and hampering commercial navigation.

In 1875, Congress began making appropriations to improve the river. The objective sought

Revocable License

No. ______

By virtue of authority conveyed by act of Congress approved March 1, 1893, the California Debris Commission hereby issues a License to ______

______

to Mine by the Hydraulic Process in the ______ Mine, near ______ County, California.

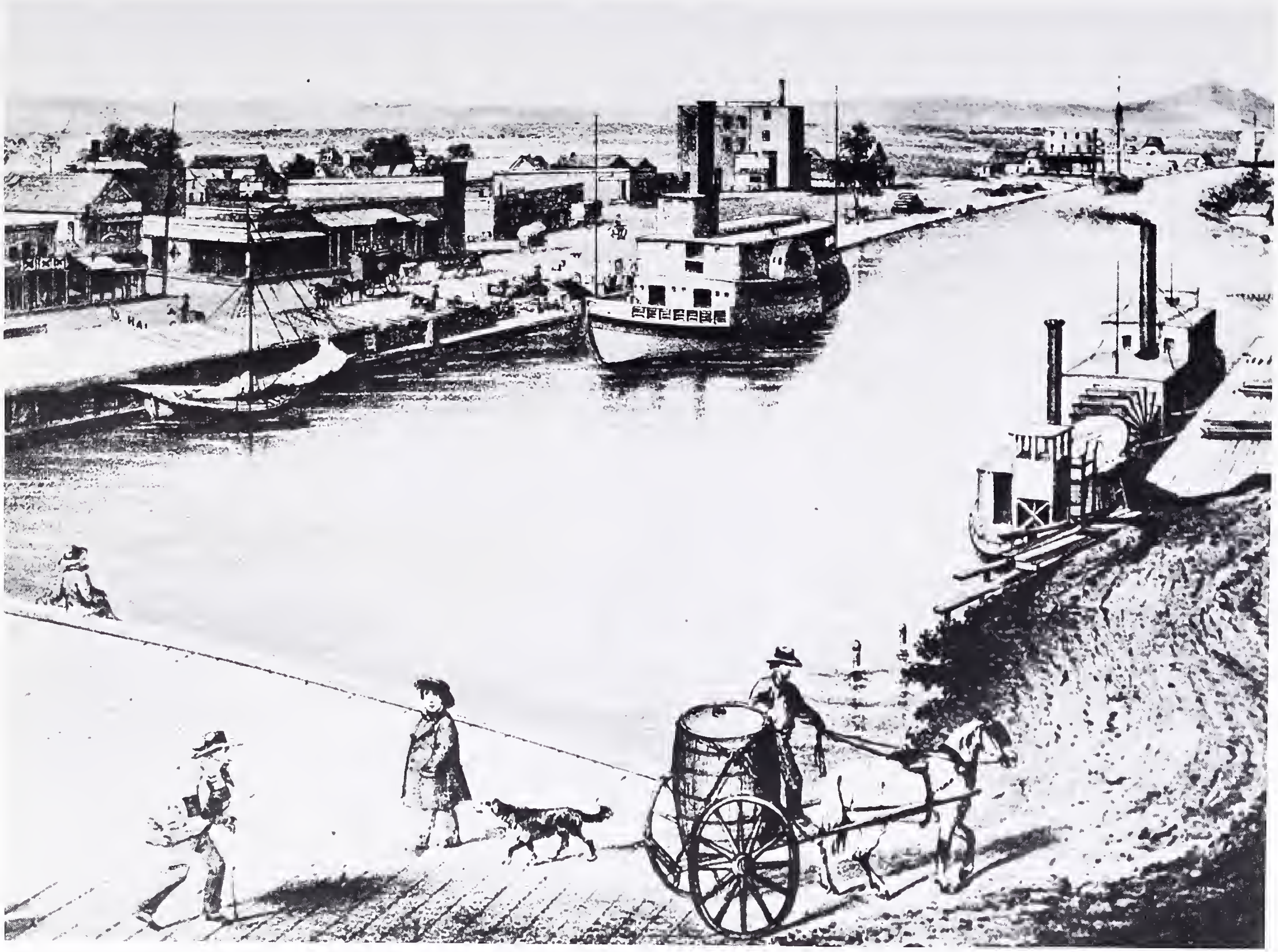
The operations of this mine are to be conducted in accordance with the instructions that may from time to time be given by the California Debris Commission.

San Francisco, Cal.,

______ 190__

______
Corps of Engineers, U.S.A.
President of the Commission.

CALIFORNIA LITHO CO S.F.



PORT OF STOCKTON, CALIFORNIA 1855
C.E. Photo

DOG DAYS AT DAGUERRE POINT DAM ON THE YUBA RIVER NEAR MARYSVILLE, CALIFORNIA, COME WITH THE HEAT OF SUMMER AS A LOYAL FRIEND COOLS HIS OWN BOTTOM WHILE KEEPING A WATCHFUL EYE ON HIS YOUNG MASTER. DAGUERRE IS A SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS, DEBRIS DAM.
(US ARMY PHOTO by Les Houde, 1967)

was to improve the depths over the bars, generally by construction of wing dams, scraping, closing of crevasses or breaks in the levees, and principally to aid navigation by the removal of snags. From 1875 to 1899 operations were carried on under small reclamation proj-

TRAINING WALLS NEAR DAGUERRE POINT DAM, DESIGNED TO HELP KEEP THE YUBA RIVER UNDER CONTROL.

LEVEE CONSTRUCTION DURING THE EARLY DAYS, WITHIN THE SACRAMENTO DISTRICT, MEANT LONG DAYS AND A LOT OF MULE POWER.
(National Archives Photos)

ects which proved themselves to be inadequate to the task of restoring the river. In 1899 a definite project for the improvement of the Sacramento was funded and work began in earnest to improve navigation. The project comprised a channel of seven-foot depth from the mouth of the river to Sacramento, a four-foot channel to Colusa, one three feet deep to Chico Landing, and "depths as practical thence to Red Bluff."

For the next four years, particularly in the immediate vicinity of Sacramento, wing dams were constructed at right angles to the banks of the river in an effort to have the current scour out the main channel. In addition, overhanging trees were cut from the banks and limited dredging was done in an effort to maintain a clear and sufficiently deep channel during periods of low water. A new snag scow, the Tackle, was put into service in 1908 for the express purpose of working between Colusa and Red Bluff. Constructed of Oregon fir, the Tackle was 64 feet long, 28 feet wide, and drew but 3½ feet of water, which made it ideally suited to work in the shallow depths up river.

While snagging, dredging and wing dam projects were being completed, the main emphasis was still directed toward halting any further debris from entering navigable waters. Hundreds of millions of cubic yards of detritus had been dumped into the Yuba alone (as much or more than all the other tributaries of the Sacramento combined). By 1905 the bed of the river near Marysville was at least 12 feet higher than it was before the days of hydraulicking. To prevent further encroachment of the flood of debris, the Commission constructed two barriers in the area where the Yuba emerges from its confined channel in the foothills. Neither proved adequate to the task of restraining the tremendous amounts of debris. During the great flood of March 1907, the barriers were breached and destroyed, allowing the debris to continue downstream.

Two other structures of a more lasting nature were built by the Debris Commission as part of its general project for control of the debris in the Yuba River. These works were begun prior to 1910 and completed in 1935. Situated about ten miles upstream from Marysville, they consist of Daguerre Point Dam, which forms a storage basin for debris, and some fifteen miles of training walls designed to keep the river within definite confines.

For the first decade of the twentieth century, progress toward reclamation of the inland waterways of the central valley, while well intended, was quite meager. As time went on it became increasingly evident that planning on a larger scale was essential if permanent and meaningful navigation, flood control and debris control projects were going to be completed.

A.D. Foote, in a paper for the American Society of Civil Engineers, summarized the situation when he stated, ". . .that work done for navigation alone is fatal to flood protection because it contracts the drainage channels in order to give depth at low water, and thus prevents the free passage of the floods. Works for irrigation alone take water needed for navigation. Mining is stopped because the debris fills the drainage channels and spreads over the farm lands. Drainage is blocked by the levee system built for flood protection; and to build levees for flood protection alone is hopeless." Antagonism among the varied interests of the Valley had to cease. Grain farmers were particularly anxious for reclamation. Foote believed that, "Fifty years of mishandling natural riches and spurning natural laws have so far injured it that now it may be said, in an economical or engineering sense, the Great Valley is lost to the world. The historic wheat fields have deteriorated until they are no longer of appreciable value to the state."

It is true that many fields were producing only a fourth of what they had originally, but to suggest that the Valley was no longer of value was bending the truth quite out of shape. The state engineer, a bit more sanguine, believed, "The first requisite is a unification of purpose and harmony of effort among the varied interests involved."

HENRY HAYES WADSWORTH
C.E. Photo

HENRY HAYES WADSWORTH

Sacramento District (2nd San Francisco District), 1905-1920. Born 13 January 1865, New Haven, Connecticut. He was graduated from Sheffield Scientific School of Yale University with special honors in 1886, at the head of the civil engineering section of his class. Appointed surveyor of the Duluth (Minn.) District, Corps of Engineers, 6 November 1896. Transferred to the San Francisco District 1 April 1905. Was commissioned a Major of Engineers in the U.S. Reserve Corps in the spring of 1917. Furloughed at his own request as chief assistant engineer 14 July 1920. As a senior civilian engineering assistant, he had a prominent part in engineering studies and surveys which led to the original adoption of the Sacramento River Flood Control Project (under the California Debris Commission); the San Joaquin River Deep Water Navigation Channel to Stockton (under the San Francisco District); and of the Hetch Hetchy water supply for the city of San Francisco (under the Department of the Interior). Mr. Wadsworth died 7 July 1923.

After years of study, the Debris Commission in 1910 recommended a comprehensive plan that would improve navigation and provide a substantial measure of flood control on the Sacramento and San Joaquin Rivers. Prepared by H.H. Wadsworth and known as the "Jackson Report" (Capt. Thos. H. Jackson was Division Engineer at the time), the plan called for the construction and enlargement of levees along the river banks and levees for artificial channels, called bypasses, to conduct the flood water in excess of the safe capacity of the river channels. Also included in the report was a recommendation to construct five weirs to discharge flood waters from the river into the bypasses, and the enlargement, by dredging, of the channel of the Sacramento from Cache Slough to Suisun Bay.

Congress didn't adopt the entire plan at once but did approve the so-called "minor project" which provided for dredging in the channel of the Sacramento River below its junction with Cache Slough. To facilitate matters, a field office was established in the Clunie Hotel in Sacramento. From the Ellicott Company in New York, two long boom clamshell-type dredges were purchased, shipped to the delta, and assembled on the banks of the river. At about the same time, 1913, a storehouse, marine ways, and mooring areas were built at Rio Vista to service the dredges and snag boats operating throughout the area. Later, a pair of twenty-inch suction dredges, christened *Sacramento* and *San Joaquin*, were built and pressed into service on the two rivers. By June 30, 1917, they had removed more than 24 million cubic yards of mud and debris from the Sacramento River below its junction with Cache Slough.

As on the Sacramento, early-day navigation projects on the San Joaquin and its tributaries reflected inadequate funding and intermittent planning. The San Joaquin rises in the southern Sierra Nevada, flows down the western slopes of the range and southwesterly until it reaches the San Joaquin Valley near Mendota where it turns and flows northwesterly to

PORT OF STOCKTON-1920s

Suisun Bay. During the final quarter of the last century, because of the poor condition of the river, only light-draft steamboats operated on the upper reaches of the river and then only during high and mean water. Before improvements were made, the main channel and the Stockton channel below the city were extremely crooked and quite difficult to navigate. Above Stockton, the river was obstructed by snags and numerous bars.

Beginning in 1874, surveys, plans, and appropriations were made for the improvement of navigation throughout the Stockton region, specifically Mormon Channel, Stockton Channel, the harbor area adjacent to the city and the upper reaches of the San Joaquin. As the Capital City became the practical head of navigation of the Sacramento, so Stockton became the commercial navigation center for the San Joaquin Valley.

By 1907 enough surveys had been completed throughout the San Joaquin that men of vision began to realize that the San Joaquin and Sacramento Rivers must be developed as a vast, single unit if full utilization and protection were to be achieved from and for the area.

Beginning in 1907, the two areas, while not completely defined, were combined into a unit known as the Second San Francisco District. During 1910-11 the "Second San Francisco District" was enlarged to include both river systems, and redesignated "Third San Francisco District." Prior to this date the Stockton area was officially a part of the "First San Francisco District." In addition, the Jackson Report outlined projects applicable to both river systems. Moreover, in 1912 authorization was given to afford the City of Stockton better harbor facilities, to be accomplished by dredging Fremont Channel and McLeod Lake to a depth of nine feet, and, as was done on the Sacramento, wing dams were placed in the San Joaquin to center the flow in the main channels. Because the river was so crooked, several cut-offs were likewise dug to straighten the waterway in order to facilitate navigation.

Even though the District had a new name, the type, quantity and value of work undertaken remained basically unchanged from that which it had been doing for years. Throughout the years prior to the first World War, the engineers of the District continued surveying, planning, and completing projects demanding ever-increasing skill and sophistication.

During the war years, the workload of the District increased. In addition to utilizing the *Seizure, Tackle, Sacramento, San Joaquin,* and the newly constructed *Bear* (government-owned boats), the District found it necessary to let contracts for much of the work to be accomplished.

From the Olympian and Ajax Dredging Companies, the clamshell dredges, *Atlas, Hercules, Thor* and *Delta*, were secured. Together, they were utilized to build levees, make cuts to straighten the channels and dig new ones.

By combining initiative, imagination and hard work the District's engineers greatly improved navigation on the inland waterways, and at the same time provided a substantial measure of flood control for Valley residents. By the end of the war, the cities of Stockton and Sacramento owed much of the prosperity to the tireless efforts of the engineers. Stockton's harbor facilities were greatly improved. Some 31,000 linear feet of water front were available, with 800,000 square feet of warehouse storage space for goods shipped to and from the Stockton area.

Sacramento suffered from a lack of sufficient facilities, even though 4,734 linear feet of wharves and 201,000 square feet of warehouse space were available for cargo handling and storage. In addition, other facilities lined the west bank of the river near the city.

Improved navigation not only brought prosperity to the cities, but aided in maintaining inexpensive water rates and promoted agricultural development throughout the Valley.

While debris control and navigation projects were being realized, the federal engineers were cooperating with state and local agencies to

SNAG BOAT BEAR
C.E. Photo

STOCKTON CHANNEL — APRIL 12, 1926 — DREDGE TENDER *FALL*, FOREGROUND. SNAG BOATS *YUBA* AND *BEAR* ALONGSIDE A PILE DRIVER, BACKGROUND. NOTE HOUSEBOATS ALONGSIDE; THIS IS WHERE THE CREWS LIVED.
C.E. Photo

formulate, integrate and prosecute plans for complex flood control projects throughout the Valley. In the main, the works contemplated were being desinged with the historical floods of 1907 and 1909 in mind. While neither discharged as much water as the flood of January 1862, they were the largest and only floods for which accurate stream flow records were available.

The State of California demonstrated a cooperative spirit by adopting the Jackson Report (1910) and at the same time created the Reclamation Board. The Board had the power to require all future plans of reclamation to conform to this report, with such modifications as might be deemed necessary.

Prior to the passage of the act creating the Reclamation Board, it was held that a man had as much right as the next to reclaim his land in whatever fashion he deemed appropriate. A report of the Reclamation Board in 1912 defined pre-existing conditions rather succinctly:

> Under the conditions obtaining up to the date of passage of this act owners of property anywhere in the basin were at liberty to reclaim practically as they pleased, with various boards of supervisors, acting independently of each other, might see fit to impose. Such restrictions rarely considered the interests of any save immediate neighbors. In consequence, each small reclamation unit, instead of acting along a general plan which would secure safety for all, was intent only on saving itself. It really levied *against* its own neighbors, and looked for its own safety through their destruction. The flood plain steadily rose because increased reclamation confined the waters more to the river channels, and there were no bypasses to rapidly carry off floods and no width of channel at the rivers mouth sufficient to discharge them. Levees steadily increased in height, adding additional burden to the land. The inevitable end, with a river channel at and below Sacramento City with a capacity of but 100,000 second-feet, and record floods of 1907, which, if in crest at the same time, would have sent 600,000 second-feet down to tide water, must be annual destruction or over-topping of levees with enormous consequent damage, and perpetual danger for all interests in the valley. No possible levees could prevent this result.

FRANK E. FREY
SACRAMENTO DISTRICT, 1902-1936
Born 13 June 1874 at Vallejo, California. Received his BS in civil engineering from the University of California in 1898. Appointed as surveyman in the Sacramento District in 1902. Was in charge of the construction of the restraining barriers on the Yuba River. Built under the jurisdiction of the California Debris Commission from January 1907 to May 1918 when he resigned to enter private contracting. He was in charge of the sub-district of the Sacramento District at Rio Vista from 1919 to 1935. He supervised dredging of the Sacramento River from the lower end of Steamboat Slough to Collinsville with contract dredges and with the Government dredges San Joaquin *and* Sacramento, *which were constructed specifically for this work on the Sacramento River Flood Control Project. He transferred to the San Francisco District 3 February 1936. Was area engineer in charge of the job of creating Treasure Island in San Francisco Bay, used as the site of the Golden Gate International Exposition. This work was accomplished largely with dredging equipment of all types available on the Pacific coast at that time, including the* San Joaquin *and* Sacramento *which were transferred from the Sacramento District. After that job, his services were utilized by the South Pacific Division Engineer on matters pertaining to dredging work carried on by the Division. In September 1940, he was placed in charge of dredging and construction incidental thereto at Midway Island. He retired from the South Pacific Division office as Senior Engineer (civil) 30 June 1944. Mr. Frey died 11 September 1948.*

By 1915 the plan, as developed by the District's engineers and adopted by the state, was

FRANK E. FREY
C.E. Photo

PADDLE WHEEL BOATS TOW A DREDGE UP THE SACRAMENTO RIVER — AUGUST 1927 — NOTE THE DREDGE TENDER ALONGSIDE.
C.E. Photo

well under way. In the Yolo Basin some 21 miles of the east levee had been constructed, and another twenty miles had been planned and approved. When completed, about forty-one miles of levee would form the entire east levee of the Yolo Bypass. Several miles of the Sutter Basin bypass levees had also been completed. New levee districts were being formed so as to aid in the completion of the project, and legislation was pending to help bring the plans to fruition. The City of Sacramento voted bonds to the extent of $594,000 for the construction of the Sacramento bypass and weir to carry the floods of the Sacramento and American Rivers to the Yolo Bypass.

In March of 1917, Congress finally adopted the Debris Commission's general plan of flood control for the Central Valley. From this point on flood control was added to the other federal activities on the Sacramento River and its tributaries. The Flood Control Act of 1917 deserves particular recognition, and is of significance, because for the first time Congress extended the federal flood control activity of the Corps of Engineers beyond the Mississippi Valley. Moreover, it affirmed the policy of local cooperation by providing that local interests should contribute substantially to construction costs. Further it authorized river surveys to be completed with a view toward flood control while requiring the Corps of Engineers to consider all other related water uses. That same year, Sacramento weir was completed by the City of Sacramento and levee construction prosecuted with vigor. Much of this construction was expedited during the years of 1917-1918 in order to reclaim as much land as possible to increase food production for the United States and its allies during World War I.

Up to this period levee construction was an obligation of state and local interests. In the years following the war, landowners decried the burdensome costs of the levees. Some of the farmers actually went bankrupt.

The Debris Commission was instructed to re-examine the projects and make appropriate recommendations. The Commission's study took the form of the "Grant Report." Just prior to publishing the report, the District was redesignated the Second San Francisco District.

Prepared for the California Debris Commission in 1922, the report called for a general survey of San Joaquin River system from Fresno to the Delta. Further, to the relief of the farmers, it and other subsequent studies adopted during the twenties put the Corps of Engineers in the "levee business" on a large scale.

From this point forward, the federal government, through the Corps of Engineers, would invest millions of dollars in levees, weirs and other flood control projects throughout the Valley. Funding was provided on a 50-50 basis with the State of California.

All did not go as smoothly as it might have, however. Levee construction, especially in the delta region, was difficult because of the unstable conditions of peat soil. Often the sheer weight of a levee would cause the earth on which it rested to sink, causing a bulging up somewhere else. On other occasions the soft earth would topple into the water soon after it was placed on the bank. Wave action under-cut levees, and without warning entire tracts would be inundated, resulting in tremendous losses. At other times the peat soil, of which many delta levees were constructed, would literally become water-logged and give way, with disastrous consequences.

The Grant Report itself was the focus of some controversy. Local Congressman Charles Curry wanted the work done by the California Debris Commission and in accordance with specifications of the report. On the other hand there was disagreement on the part of the Office of the Chief of Engineers (OCE) in Washington. The Congressman got his way, the disagreement by the Office of the Chief of Engineers was overridden, and the work was done by the California Debris Commission in accordance with specifications set forth in the report.

From the early twenties, the California Debris Commission received fewer and fewer projects, with the bulk of the workload being transferred to and supervised directly by the Second San Francisco District engineers. And, while the twenties "roared" for many, river

traffic, particularly during the early twenties, suffered a conspicuous decline. Several dry years followed one after the other. Expanded irrigation projects took vast quantities of available water from the rivers, until, in many areas, the Sacramento and San Joaquin were little more than isolated puddles. With inexpensive water transportation curtailed, farmers turned to the railroads and trucks to move their produce, which further damaged the navigation companies. Then in March, 1925, the Corps of Engineers and the Federal Power Commission were directed to prepare and submit to Congress cost estimates for surveys of navigable streams where

> . . .power development appears feasible and practicable, with a view to the formulation of general plans for the most effective improvement of such streams for the purpose of navigation and the prosecution of such improvement in combination with the most efficient development of the potential water power, the control of floods and the needs of irrigation.

In April of the next year Major General Taylor, Chief of Engineers, and O.C. Merrill of the Federal Power Commission, through the Secretary of War, sent to Congress "A letter . . . showing all navigable streams upon which power development appears to be feasible and the estimate of cost of examinations of the same . . ." Included on the list of twenty-four major streams (or stream groups) to be studied were "Streams emptying into the Pacific Ocean south of Columbia River as follows: Eel, Mad, Klamath, Sacramento, San Joaquin, Kern." It was estimated that $420,000 would be needed to prepare the cost estimates for these rivers. House Document 308, as the report became known, launched and guided the most extensive study of the nation's and Sacramento District's water resources undertaken to date.

The following year, the extensive and fundamental River and Harbor Act of 1927 charged the Corps of Engineers with the responsibility of completing the surveys recommended in House Document 308.

From the standpoint of water resources development, the studies were of enormous impact. For the first time in history, the streams of the entire nation would be inventoried with a view toward integrated development. It is probable that the increased amount of work generated by the 1927 Act was the decisive factor in the establishment of the Sacramento District only two years later, in 1929.

With the change in policy regarding levee construction, the Second San Francisco District expanded its work force, prepared new projects and revised existing ones. During the late twenties, improvements (and modifications) were made to the Feather River Project, the Sacramento River Shallow Draft Channel and the Sacramento River Flood Control Project. Included in the latter were hundreds of miles of levees which protected hundreds of thousands of acres of rich farm land.

The Stockton Deep Water Channel was also authorized during this period. Since 1876 navigation projects had been prosecuted on the San Joaquin River, but it was the 1927 Rivers and Harbors Act that finally incorporated plans for a deep water channel from the Bay Area to the City of Stockton.

With the change in basic policy and the increased workload of the area, by 1929 responsibility was transferred from San Francisco and given to the newly-created Sacramento District.

HENRY M. RICH
SACRAMENTO DISTRICT, 1910-1949

Born 14 August 1889 at Wheatland, California. Attended Vander Naillen and Healds Technical Colleges in San Francisco and prosecuted various extension courses offered by the University of California. Worked on public land surveys for the Fageol Truck Co., Oakland, and as a leverman on gold dredges at Hammonton, California. Entered Government service in 1910 and worked as a surveyman and field draftsman on the general surveys of the Sacramento and San Joaquin valleys being performed by the Corps. Was placed in charge of snagboat operating on the Sacramento and San Joaquin rivers in 1915. Was commissioned a Lieutenant of Engineers in World War I. Took

HENRY M. RICH
C.E. Photo

charge of the Sacramento sub-office of the Second San Francisco District in 1919, building levees and flood control weirs and maintaining the Sacramento River navigation channels. When the Sacramento District was formed in 1929, he retained his position as chief of the Sacramento sub-office and in 1940 became Chief, Construction-Operations Division, Sacramento District. He became Chief Civilian Engineer and special assistant to the District Engineer in 1942, continuing in this capacity until 1949 when he retired.

Mr. Rich's exceptional ability to get things done was invaluable to the Sacramento District, particularly during the accelerated construction period of World War II. He would try anything once, and then a second time to see why it hadn't worked the first time. Henry may not have known the meaning of "essayons", but he certainly operated by this credo. Mr. Rich died in 1974 at the age of 85.

LTC. T. H. EMERSON, SACRAMENTO DISTRICT ENGINEER, AUGUST 1928-SEPTEMBER 1929
C.E. Photo

CHAPTER III
PROBLEMS AND PROMISES

For all intents and purposes the boundaries of the Sacramento District, for many years after establishment in 1929, corresponded to those of the Great Central Valley of California, an area occupying about 35% of the entire state. During the District's formative years, the economic base of the area rested upon agriculture. Even though the region contains little more than a third of the state's total area, in excess of 60 percent of the state's arable land was found there. In 1930 the estimated value of the land, buildings, equipment and live stock utilized by those engaged in agricultural pursuits throughout the Valley was approximately fifteen billion dollars.

During the early 1930s the Central Valley along with the rest of the country sank to the depths of economic depression. In a desperate and at times pitiful struggle to survive, the farmers attempted to irrigate as much land as possible. These efforts coupled with years of subnormal run-off only complicated an already deteriorating situation.

Conditions were particularly acute in the San Joaquin Valley. Years earlier as surface water supplies became exhausted, the farmers tapped the water stored beneath the Valley floor. These subterranean waters were so plentiful that, as long as California was sparsely settled, extractions from wells made hardly a noticeable difference in water levels. After each rainy season the levels rebounded to their previous highs. Little wonder those who dipped the water out thought of ground water as a continuous, limitless supply.

During the twenties and thirties, irrigated areas entirely dependent upon a supply pumped from ground water increased rapidly, though the water levels underlying the Central Valley receded steadily. In some areas, by 1930, even the underground supply either had become exhausted or levels had declined to the extent that pumping costs became prohibitive.

Another area of concern was the invasion of saline water into the Sacramento-San Joaquin Delta channels rendering the water unfit for irrigation, industrial or domestic use. As an extension of the San Francisco Bay system, the ebb and flow of tides made the channels vulnerable to assault by ocean water.

High rivers of winter and spring push the salty water towards the Bay, but as flows diminish in late summer and fall the saline waters filter upstream into the fresh water of the Delta. Diversion for irrigation greatly facilitates the intrusion of sea water. Salt water made its deepest penetration into the state's mid-section in 1931. During that record-breaking period of low run-off the corrosive solution found its way up river as far as Stockton.

Men have been seeking answers to the saline intrusion problem since they recognized it back in the 1850s. During the early 1930s they initiated positive measures to correct the ruinous situation.

The Sacramento District Corps of Engineers was also concerned about impaired navigation on the state's inland waterways, a condition abetted and aggravated by extensive upstream diversions and abnormally low runoffs. Many an "old timer" recalls those days when the rivers above Sacramento and Stockton were as devoid of water as was "hell on a hot day. If a fish wanted to get from Red Bluff to Sacramento, he'd have had to take the train."

Comparative commercial statistics validate such recollections. The value of products shipped on the Sacramento and San Joaquin Rivers during 1931 had tumbled some 30% from the previous year. A decline in tonnage as well as market value contributed to the loss of revenue. To the grain and orchard farmers "up river," it didn't make a bit of sense to load a boat that lacked the water to float it. In a report of the Board of Rivers and Harbors in February of 1931, Colonel Deakyne pointed out that "In the Sacramento Valley, irrigation has expanded to the point where it absorbs almost the entire low water flow of the river in years of subnormal runoff. This results in a serious handicap to navigation above Sacramento and permits the incursion of salt water into the delta channels . . ." He went on to state that much the same condition existed in the southern San Joaquin Valley and added that, "The use of underground water has been so extensive that the water table has lowered to a point where many wells have gone dry . . ."

On the other hand a flood of major proportion has, on the average, occured within the Sacramento District every seven years. With the exception of levees and bypasses little had been accomplished to permanently stay the disaster that regularly visited the residents of the region.

In the same report Colonel Deakyne restated the deplorable state of affairs brought on by unrestricted hydraulic mining, which not only caused serious difficulties to navigation but increased flood heights and flood frequency as well. Hence, it was apparent that the culprits, debris, drought, and flood, while tried and convicted, had not yet been apprehended and punished to the satisfaction of their victims.

Other agencies besides the Corps of Engineers were also deeply involved in the search for answers to the inimical enigma: The Central Valley's water problem. The engineers of the Sacramento District cooperated fully with the State of California and the U.S. Bureau of Reclamation to make the development and control of the water resources within the Sacramento District an integrated part of and a meaningful contribution to the successful management of water resources throughout the West.

The State's water plan, as outlined by Robert B. Marshall, assumed rather definite form during the early 1920s. In the main, it called for the export of surplus water from the Sacramento River to the San Joaquin Valley by way of a series of canals and the construction of a dam across Carquinez Straits. By 1925 a more definitive proposal was submitted to the legislature which included several modifications to the earlier plan. Extensive study continued on behalf of the state until in 1933 the California legislature passed the Central Valley Project Act.

Initially the Act proposed storage reservoirs at Kennett (Shasta) on the Sacramento River, Oroville on the Feather, Folsom on the American and at Parker on the Bear River. Additional water was to be supplied to the Sacramento River through a diversion tunnel from the Trinity River area.

LEFT TO RIGHT MAJOR J.R.D. MATHESON, SACRAMENTO DISTRICT ENGINEER; CAPTAIN WOOD; W.M. COFFEY, PROJECT ENGINEER; COLONEL ROBBINS, SOUTH PACIFIC DIVISION ENGINEER; OWEN G. STANLEY, CHIEF OF ENGINEERING DIVISION — SACRAMENTO DISTRICT. TAKEN BY HENDERSON MCGEE AT PITTSBURG, CALIFORNIA ON APRIL 14, 1930 TO COMMEMORATE THE INITIATION OF WORK ON THE STOCKTON DEEP WATER CHANNEL.
(Photo courtesy H.E. McGee)

The Corps of Engineers, while recognizing the importance of irrigation, reminded the state that federal laws gave priority to navigation and therefore sufficient water should be retained in the Sacramento River for maintenance of navigability. Delta farmers were also demanding high summer flows to curtail the severe damage from salt water intrusion, due in part to upstream consumptive use.

Several schemes for financing the state water plan were explored without success. Finally, in the face of increasingly critical conditions of water shortage and economic distress, construction of the Project was authorized as a federal undertaking in 1935.

The River and Harbor Act of 1935 (August 30th) contained the initial authorization for the Central Valley Project. This initial authorization provided for construction by the Corps of Engineers. Just a month earlier the Public Works Administration Advisory Committee on Allotments recommended that $20 million be allotted for the Central Valley Project. For a moment at least, it appeared as though the Sacramento District would design and supervise the construction of one of the most ambitious water projects in the country.

Excitement and euphoria on the part of Captain J. G. Drinkwater, District Engineer, and the engineers of the Sacramento District was soon replaced by disappointment and disenchantment when it was learned that Franklin Roosevelt, by executive order, transferred the $20 million to the Department of the Interior. On September 16, 1935, Harold L. Ickes, Secretary of the Interior and Administrator of Public Works, announced that the Bureau of Reclamation was to build the first units of the Central Valley Project.

It was Dr. Elwood Mead, Reclamation Commissioner, who determined the structures that were to be completed during the initial phase of construction. He suggested that a dam at Friant on the San Joaquin River and a larger one at Kennett (Shasta) on the Sacramento (the key unit of the project) would be the principal work undertaken. At the same time various canals, conduits and power transmission lines would be built as part of an integrated system to provide flood control, electric power and water for irrigation. Controlled releases from Kennett Dam, it was hoped, would also halt the encroachment of salt water into the Delta.

WALTER M. COFFEY, LEFT, HENDERSON E. MCGEE NEAR STOCKTON — SEPTEMBER 1930
(Photo courtesy H.E. McGee)

Although disappointed because of the rather novel shift in authority for the Central Valley Project, the Sacramento District continued to cooperate with the State of California and the Bureau of Reclamation. Over the years the District has actually constructed some of the vital components of the Central Valley Project.

Meanwhile Sacramento District personnel, under the supervision of Major J.R.D. Matheson, District Engineer and O.G. Stanley, Chief of Engineering and Construction, continued working on four major projects: Sacramento River Flood Control, Sacramento River Shallow Draft Channel, Stockton Channel and

MAJOR J.R.D. MATHESON, SACRAMENTO DISTRICT ENGINEER, SEPTEMBER 1929—JANUARY 1932

SNAGGING

POWDER MONKEYS — 1936.
SAM KAHIONA, CENTER

FRONT ROW: SAM NAIOLE, J. KAHIONA, BILL LINT, SAM KAHIONA
BACK ROW: B. STEWART, M. FALL, JACK HILO — 1932.

SNAGGING OPERATIONS WERE CARRIED ON BOTH ABOVE AND BELOW THE WATER. THE OFTEN DANGEROUS WORK WAS ACCOMPLISHED BY "POWDER MONKEYS" AND "HARD HAT DIVERS." WHEN SNAGS WERE TOO HEAVY TO LIFT OUT OF THE RIVER, DYNAMITE WAS ATTACHED TO BLOW THE OBSTRUCTIONS OUT OF THE WATER. ON ONE OCCASION THE CHARGE BROKE LOOSE AND ALMOST BLEW THE DIVERS OUT OF THE WATER INSTEAD OF THE SNAG.
(Photos – Sam Kahiona)

Suisun Bay Channel. Like his immediate predecessor Lt. Col. T.H. Emerson, Major Matheson directed the energies and skills of the District in a three pronged attack to improve conditions and expand facilities throughout the District. As before, the critical issues at hand were the needs of navigation, reclamation and flood control. In addition, the "308" studies were prosecuted vigorously during the early thirties, with initial recommendations being put forth in 1931. More than a dozen major projects would eventually be completed as a result of these in-depth investigations. All the notable and indispensable dams and reservoirs found in the Sierra foothills, built by the Sacramento District, had their beginnings with the "308" studies.

It must be remembered that the District was formed just as the nation plunged into the worst economic depression it had ever experienced. Millions stood in bread lines, foreclosures put families in the streets, savings were wiped out in a matter of hours. Adding to the man-made misery, nature created a dust bowl of the nation's heartland. Countless refugees blown out of the dust bowl re-established themselves within the confines of the Sacramento District. To ease their burden, the

1929 — SAND DREDGER SUNK AT MOUTH OF AMERICAN RIVER.

federal government spent billions of dollars to create jobs, stimulate the economy and restore a sense of pride in the people.

When Major J.R.D. Matheson assumed responsibility for the District on September 11, 1929, it embraced the drainage basins and delta waterways of the Sacramento and San Joaquin Rivers above their confluence at the head of Suisun Bay, and those parts of southern Oregon and of northwestern Nevada which constitute that portion of the Great Basin that tends to drain toward central Nevada. By the time Captain Drinkwater took command in February of 1932, the District was enlarged to include Suisun Bay.

Under the able leadership of Matheson, Drinkwater and Wood,[1] the Sacramento and San Joaquin Rivers and the Delta and Suisun Bay received careful attention during the first half of the 1930s. The existing San Joaquin River-Stockton Deep Water Channel project was 97% complete by 1935. A channel 30-feet deep with bottom widths from 150 feet to 300 feet had been provided for more than 40 miles, from Suisun Bay to Stockton. Beginning back in August of 1876, the Engineers had worked continuously (for almost 60 years) to straighten and deepen the natural waterway that leads to the very heart of the Great Central Valley of California. By building miles of levees, dredging millions of cubic yards of material, cutting off sharp bends, snagging, constructing wing dams and removing thousands of obstructions from the natural and manmade channel, the Engineers had provided a safe and swift thoroughfare for ocean-going vessels. Previously completed works in and about the Stockton-Delta area were also maintained.

Work on the Sacramento River during the early 1930s was similar to that prosecuted on the San Joaquin. The existing project which made provision for a channel ten feet deep and from 150 to 200 feet wide had been maintained from the mouth of the river near Collinsville to Sacramento since its completion in 1931. Work

[1]Capt. W.A. Wood, Jr. C.E. Acting D.E. January 24, 1932 to February 16, 1932.

on the Sacramento River began in 1875, and by the depression years the Corps of Engineers had studied, surveyed and examined the "River of Gold" until they knew all its problems and promises. They had leveed its sides, scraped and dug out its bottom, and made provisions to relieve the river of its excess water by allowing the floods to escape to bypasses through a system of strategically placed weirs.

The shallow-draft channel was completed in 1931, so that only maintenance work was needed for the remainder of the decade. The flood control work, however, has continued to the present time. The removal of tens of thousands of snags not only aided navigation, but allowed the river to flow with greater ease, thus adding measurably to its carrying capacity and thereby reducing the danger of flooding. In addition to dredging millions of cubic yards of mud, muck and debris from the river's bottom, hundreds of wing dams placed in the stream forced the Sacramento to scour out its main channel. These measures proved so effective that by 1935 the low water level of the river at Sacramento had receded to the same level it was in 1849, prior to the beginning of hydraulic mining. Even the low-water level of the Yuba River at Marysville had dropped eleven feet below its 1905 level.

A modification was made in 1935 to the project (Act of 21 January 1927) which recommended the head of navigation be changed from Red Bluff to Chico Landing. Further, the River and Harbor Act of August 30, 1935, provided for a depth of six feet between Sacramento and Colusa, and five feet between Colusa and Chico Landing, provided that the flow of the river would be increased to a minimum of 5,000 cubic feet per second upon completion of the Kennett Dam and Reservoir (Shasta). Finally the federal government, through the Corps of Engineers, authorized a special direct contribution of $12,000,000 for the construction of the Kennett Dam.

SACRAMENTO WEIR IN OPERATION. THE CITY OF SACRAMENTO IS IN THE BACKGROUND.
C.E. Photo

The Suisun Bay Channel was another project substantially completed by 1935. The original work was adopted by the River and Harbor Act of March 2, 1919, and authorized by the far reaching Act of 21 January 1927 and modified by the River and Harbor Acts of July 3, 1930 and August 30, 1935. The controlling depth in the main channel is 30 feet, and 20 feet in the channel south of Seal Island. The widths of the channels are 300 feet and 250 feet respectively.

Located about thirty miles northeast of the Golden Gate, Suisun Bay is an integral part of the waterways which provide access to inland ports from the Pacific Ocean. Moreover, the Sacramento and San Joaquin Rivers form a junction and empty into Suisun Bay near Collinsville; New York Slough, a distributary of the San Joaquin, leads to the head of the bay at Pittsburg. This interconnecting link between San Francisco Bay and the navigation channels of the Sacramento and San Joaquin Rivers permits transit of nearly all types of vessels.

Under the provision of the River and Harbor Act of July 3, 1930, local interests were supposed to pay $20 thousand to deepen the channel across Bulls Head Point Shoal, but this requirement was voided when the project became a part of the Public Works program.

In an effort to continue the orderly development of the nation's water resources and provide additional means of support for the millions still unemployed, Congress passed the Flood Control Act of June 22, 1936[2] A landmark decision by Congress, this far-reaching Act launched the "Benefit-Cost Ratio" concept. Section I of the Act provided

> . . . that investigations and improvements of rivers and other waterways, including watersheds thereof, for flood-control purposes are in the interest of the general welfare; that the federal government should improve or participate in the improvement of navigable waters or their tributaries, including watersheds thereof, for flood-control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected.

1928 — STERN WHEELER *"DOVER"* HOMEWARD BOUND WITH GRAIN FROM BUTTE CITY, CALIFORNIA
(Photo – Sam Kahiona)

Regardless of the fact that the statutory directive was pertinent to only flood control improvements by the Corps of Engineers and the Department of Agriculture, it was soon employed by several other water planning agencies. Often as not, however, each agency adopted different and, at times, inconsistent criteria for establishing benefits and costs. As the decade of the thirties drew to a close, the Corps of Engineers, as well as other agencies, became increasingly concerned with the social, general, and potential benefits of a project as

[2]Public Law No. 409 — River and Harbor Act of 1935 — Section 6. Congress instructed the Corps of Engineers to update and continue the 308 investigations. "That the surveys authorized pursuant to section 1 to the River and Harbor Act of January 21, 1927, and House Document Numbered 308, Sixty-ninth Congress, first session, shall be supplemented by such additional study or investigation as the Chief of Engineers finds necessary to take into account important changes in economic factors as they occur, and additional stream flow records or other factual data."

1927 — STERN-WHEELERS TIED UP AT BRODERICK; IN THE FOREGROUND "SAN JOAQUIN NO. 2"

THE "*PUTAH*" PUSHES A DREDGE UP THE RIVER — Ca. 1930
(Photos – Sam Kahiona)

well as the economic and special advantages to be gained.

Another important aspect of the 1936 Act was the method and amount of repayment to the federal government for improvements made for local agencies. Since the end of World War I the Chief of Engineers, when submitting reports to Congress, had been required to outline the expected local benefits and to suggest an appropriate degree of local participation. Over the years, levee districts, landowners, municipalities and states had provided money, lands, rights of way and terminals, but the waterways themselves were considered as free public highways, hence there was no provision for repayment of costs of a navigation project by tolls. This meant that the major commercial carriers of the Sacramento, San Joaquin and the other navigable rivers of the nation made no contribution to the development and maintenance of navigation improvements. But since the benefits accrued to the general public in the form of reduced shipping charges, the benefits were considered widespread and in the general welfare.

Just as the 1927 Act was responsible for the establishment of the Sacramento District as such, the Act of 1936 proved to be the catalyst for expansion. All of the projects determined feasible by the "308" studies and the 1927 Act were now to be studied in depth with a view toward actual construction. The resultant modifications to the Sacramento District's staffing pattern was without precedent. To complete the surveys the District's personnel was multiplied more than fivefold.

By the time the investigations could be initiated, it was late 1937. To recruit the additional manpower needed to complete the work, Major Bruce Hill, Chief of Engineering for the District, went to the University of California at Berkeley and offered to employ the top third of the graduating class of 1938 who had majored in civil engineering. Consequently, many of the 1938 engineering graduates at Berkeley joined the Sacramento District within a year or so. There were about twenty in all. Some remained for but a short time; others stayed for many years. Included among the latter were Jack Barrish, Robert Cook, Randolph Dewante, William Doyle, Alfred Geandrot, Amalio Gomez, Toivo Panttaja, William Stecker, Ralph Stowell, Gerard Weeshoff, William Yallalee, and Arnold Zimmerman. Most of these men were recruited by Major Hill through Professor B.A. Etcheverry of the University. When the first contingent arrived in Sacramento on 1 June 1938 and reported to Major Hill, some had naively assumed they had already been hired. They were somewhat taken aback to learn that they were only reporting for an interview. However, all ended happily, for after talking to them, Major Hill hired them all. This proved fortuitous; the group was the nucleus that provided the leadership that has made the Sacramento District one of the finest in the nation.

The new recruits were assigned to several regional planning offices in Fresno, Carson City and Stockton. This group of men did an outstanding job, considering their limited experience and the abscence of established precedent in major flood control studies.

Under the direction of Lt. Col. L.B. Chambers, appointed District Engineer in 1936, the extensive surveys were begun. Eventually they led to the authorization of some seventeen major projects within the District.

1. *Big Dry Creek Reservoir*
2. *Isabella Dam and Reservoir*
3. *Pine Flat Dam and Reservoir and Kings River Channel*
4. *Success Dam and Reservoir*
5. *Terminus Dam and Reservoir*
6. *Lower San Joaquin River and Tributaries*
7. *Tuolumne River Reservoirs*
8. *New Melones Reservoir*
9. *Merced County Stream Group*
10. *Bear Creek*
11. *Farmington Reservoir*
12. *New Hogan Reservoir*
13. *Sevier River*
14. *Black Butte Reservoir*
15. *Folsom Reservoir*
16. *Sacramento River and Major and Minor Tributaries*
17. *Table Mountain Reservoir (Iron Canyon)*

The studies involved four basic considerations: 1. What is the best possible way to develop a river? 2. What will it cost? 3. Who should pay the bill? 4. Will benefits be greater than cost?

By the time civil works planning was essentially suspended late in 1941, after Pearl Harbor, the survey reports were completed for most of the projects. This enormous amount of work was done in just three years, and the rate of output has not been equaled since. A member of this group has suggested, with some justification,

> . . . the reason the job was done so fast was that we knew so little about it. In retrospect, I like to think that it was principally due to the lack of written instructions from above. We were left relatively free and we did the best we knew how; and generally, though not always, our best was good enough.

It would be difficult to exaggerate the boldness of the New Deal Congress which enacted the Flood Control Act of 1936. Such action was more in line with Doc Savage "The Man of Bronze," hero of the Depression's Youth, than a group of federal law-givers. The 1936 Act gave birth to two new concepts: 1. Benefits, both direct and indirect to the nation as a whole, and 2. Flood Control on a comprehensive scale. Considering time and circumstance such conduct on the part of Congress, if not intrepid, was at least unprecedented.

During the latter part of the thirties, District personnel, in addition to initiating the studies called for by the 1936 Act, busied themselves with new projects both large and small. Two of the lesser projects, Middle River and connecting channels, and the Old River work, were both completed prior to World War II.

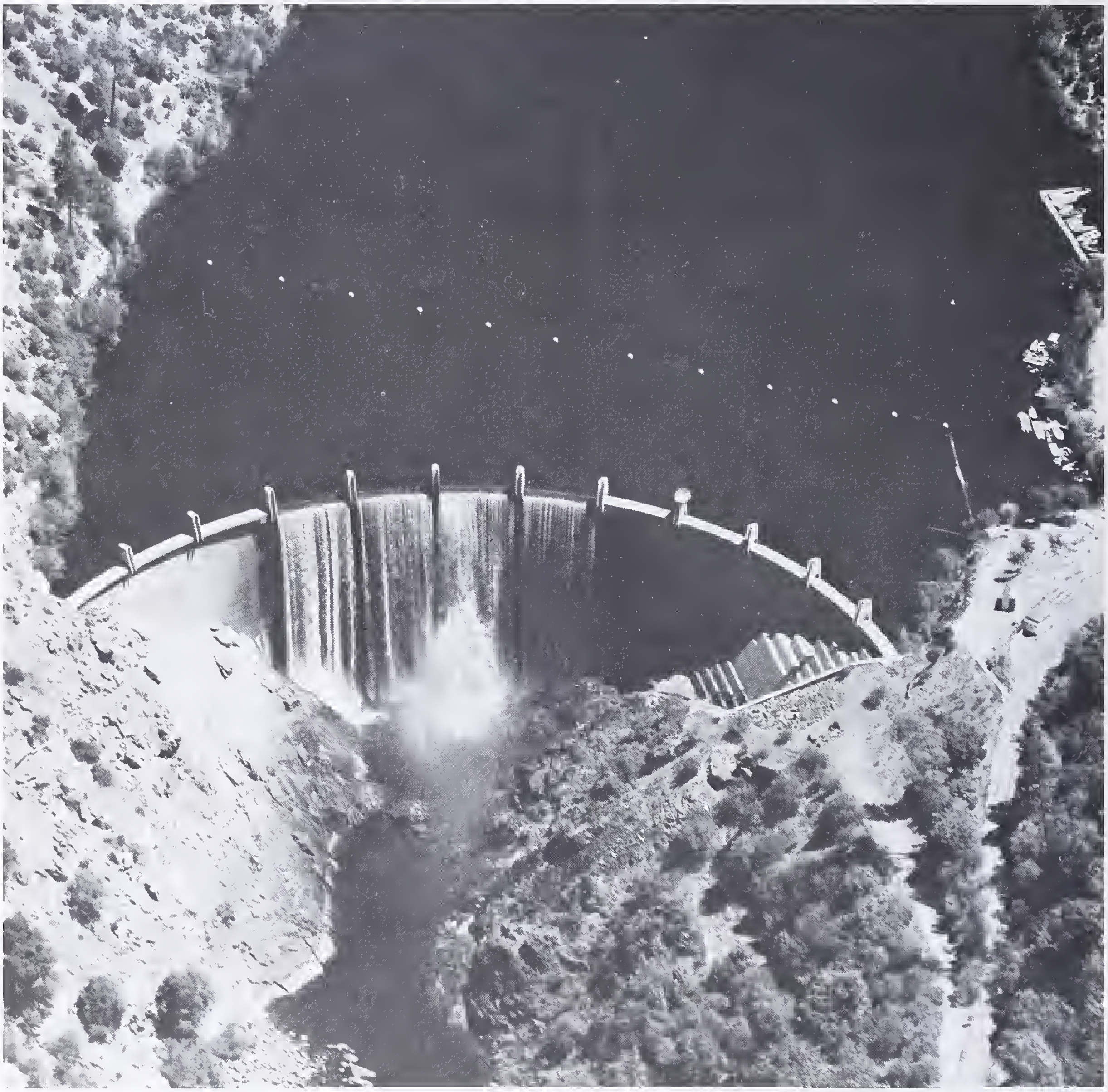
These waterways form a part of the complicated tangle of tidal channels, some natural and some artificial, that form the aquatic labyrinth known as the San Joaquin-Sacramento Delta. Middle River improvements were begun in 1930 and completed by 1937. Channels nine feet deep and one hundred feet wide were dredged in Middle River, Empire Cut, Turner Cut, Whiskey Slough, and Latham Slough. (See Map)

Middle River, a bychannel of the San Joaquin River, and a principal artery of the Delta maze, leaves Old River, another bychannel, above the city of Stockton and rejoins the main river below the city. Turner Cut enters the San Joaquin upstream from Middle River and is connected by Empire Cut to Latham Slough and Middle River.

Old River, only twenty-eight percent complete (1973) and classified inactive, was authorized in the summer of 1937. The main channel is the most westerly of those into which the San Joaquin River divides as it meanders through the Delta. When and if completed the project will include a channel along Old River from its mouth near Venice Island to Lammers Ferry Road; a side channel at Orwood; a channel in Grant Line Canal; a channel through Doughty Cut to the Holly Sugar factory; a channel from Doughty Cut to the head of Old River; and for entrances to Fabian-Bell Canal. According to the latest data available, existing improvements in the Delta are adequate for present navigation needs. Even so, studies are presently underway to determine future needs for this important region.

LIEUTENANT COLONEL L. B. CHAMBERS, SACRAMENTO DISTRICT ENGINEER,
AUGUST 1935 — AUGUST 1940

HARRY L. ENGLEBRIGHT DAM ON THE YUBA RIVER. (Ca 1969)
(Army Corps of Engineers Photo)



NORTH FORK DAM, ON THE NORTH FORK OF THE AMERICAN RIVER. CONSTRUCTION WAS INITIATED IN 1937; IT WAS COMPLETED AND IN USE AT THE END OF THE FISCAL YEAR 1939. THE RESERVOIR IS LOCATED ABOUT 5 MILES NORTHEAST OF THE CITY OF AUBURN AND 40 MILES NORTHEAST OF SACRAMENTO. THE DAM IS 155 FEET HIGH, 620 FEET LONG; THE RESERVOIR HAS A DEBRIS STORAGE CAPACITY OF 26,000,000 CUBIC YARDS. THE PRIMARY PURPOSE OF THE PROJECT WAS TO MAKE POSSIBLE THE RESUMPTION OF HYDRAULIC MINING IN THE TRIBUTARY WATERSHED FOR WHICH THE MINERS ARE REQUIRED TO REIMBURSE THE UNITED STATES ACCORDING TO THE DEBRIS CONTRIBUTED AT A SET PRICE PER CUBIC YARD MINED.

(Army Corps of Engineers Photo)

CHAPTER IV
THE DISPLACED AND THE DETERMINED

Probably the most exciting, controversial and impressive projects undertaken during the last years of the Depression were the debris dams built on the American and Yuba Rivers and the proposal for a deep-water ship channel from the Delta to Sacramento. As was pointed out earlier, the idea of mining by the hydraulic method was never really abandoned. The economic famine of the thirties was so complete that even the rehabilitation of the hydraulic mining industry was seen as a possible solution to put food in the bellies of the unemployed.

Section 5 of the Act of 1893 (as amended) which organized the California Debris Commission directed the Engineers to "determine the utility and practicability . . . of storage sites . . . for the storage of debris or water or as settling reservoirs." From time to time the California Debris Commission had reported on the feasibility of constructing dams for the impounding of debris from hydraulic mining with a view to rehabilitating the industry.

But just as in the old days, when the "flatlanders" got wind of what the "mountain folks" were up to they raised their collective voices in protest. They went so far as to hire an engineer, Otto von Geldern, to investigate the rehabilitation of hydraulic mining by the building of high dams. As might be expected, von Geldern's study revealed that resumption of hydraulicking meant certain doom for the Valley.

In his report, he suggested that regardless of the economic conditions of the time, the whole matter revolved around the safety of the Valley and those who resided there. He pointed out that the reliability of such dams as those proposed could not be assured, nor could the effect of the fill on such structures be definitely known. Hence, such barriers would be a grave threat to the valley.

Von Geldern held that the whole idea of rehabilitation was nothing more than a dangerous experiment. He recalled that similar structures had been used in the Alps and Appenines, but that not even these were of the "extraordinary dimensions and of such enormous voluminous capacity to hold back avalanches of debris" as those proposed for the Sierra. Finally, he believed it to be dangerous to "trifle with the great forces of nature which in geological ages have been brought to something like a stable equilibrium . . ."

Supporting von Geldern were others of note: Professor Robert Unser, Dean of the College of Mines of the University of California, and Ross E. Browne, a well-known mining engineer of the time. And, of course, reference could always be made to the landmark study done by Gilbert (Karl Grove Gilbert, *Hydraulic Mining Debris in the Sierra Nevada*, 1917). All believed hydraulicking was a menace to the public welfare.

In summary, their arguments were: 1. High dams were dangerous; 2. Rehabilitation was financially unsound; 3. Only a few might prosper at the expense of thousands; 4. Future generations would suffer; 5. Reservoirs would fill and become useless; 6. The government, state or federal was not in the mining business, nor would it be sound public policy for either to be so; 7. Water was more important than gold for California; 8. New legislation would deprive the people of the right of injunction.

Those favoring rehabilitation were just as dedicated to the merits of their cause. Probably James D. Stewart presented the case for the miners as well as anyone. He remarked, "I was born and reared within the sound of the roar of the hydraulic monitor and giant. My schooling and living has (sic) been wrested from the gravels of the hills I have always loved."

Stewart disclosed that during the previous forty years, the damage suffered by the agricultural interests had been largely repaired, and in some cases the land had actually benefited from the debris washed out of the mountains. The hydraulic mining industry, on the other hand, had been wiped out and those endeavoring to rehabilitate the industry had met only sneers and scorn.

Stewart complained further that while agrarian interests were violently opposed to state or federal aid to miners, they gladly accepted financial assistance. To the charge that hydraulicking would prove to be unprofitable, he suggested that this was a matter concerning

PERSONNEL — U.S. ENGINEER OFFICE, SACRAMENTO, CALIF. — MARCH 25, 1937

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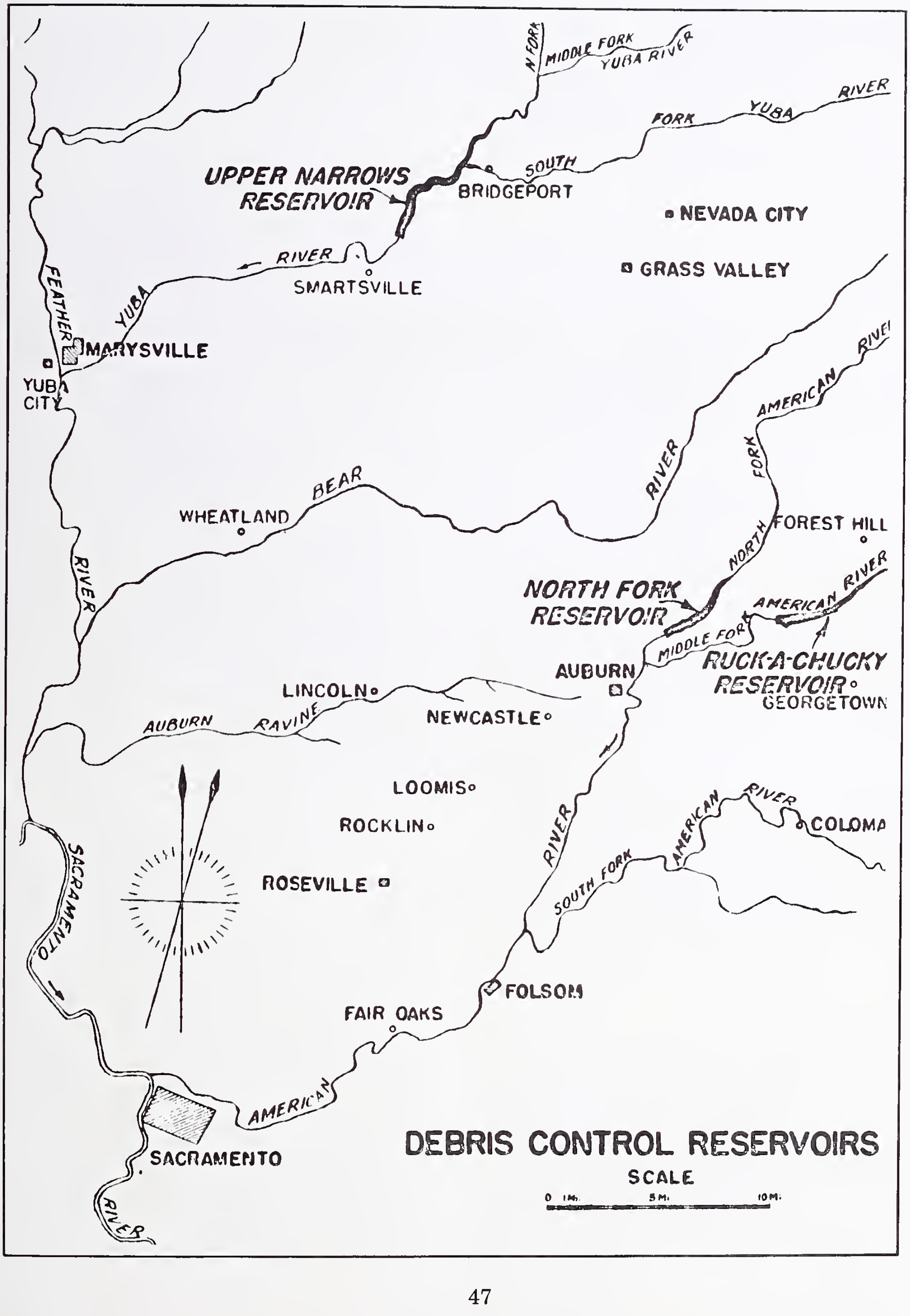
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RIVER
SMARTSVILLE
FEATHER
YUBA
MARYSVILLE
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CITY
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AMERICAN
RIVER
FORK
BEAR
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SOUTH FORK
FOLSOM
FAIR OAKS
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SACRAMENTO
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DEBRIS CONTROL RESERVOIRS
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the hydraulickers alone. Stewart put forth a six-point program covering construction and repayment of the high dams:

1. The state and federal governments make the necessary appropriations to build these dams.

2. That these dams be built by, and be under the supervision of the California Debris Commission.

3. That no dams be built on any stream until the hydraulic miners on that stream have filed a written petition with the California Debris Commission, asking that such a dam be built, and deposit sufficient funds with the Commission to cover the initial inspection of the project by the Commission's engineers.

4. That the petition shall state how many cubic yards of gravel the petitioner expects to work.

5. That no dam shall be built until the petitioners file an undertaking or bond that they will work the amount of yardage stated in their petition.

6. That when the dam is built, they will file with the Commission a further bond to cover payment of the storage of the debris behind the dam.

Further, he claimed tremendous direct and indirect benefits would befall the state if the dams were built and hydraulicking resumed. He predicted that a total of $600,000,000 could be directly recovered by hydraulicking. Some of the indirect benefits, he believed, would be more far-reaching than the direct. The debris dams would be an integral part of flood control, irrigation, salinity control in the Delta region, and the navigation plans of the state as a whole. Moreover, hydraulic work, performed during the winter months, would draw off the unemployed from the cities and farms, thus stabilizing the labor force.

Evidence, argument and expert opinion was proffered, in abundance, from both sides causing the level of hostility to rise and the polarization of public opinion. Though defeated year after year, the supporters of rehabilitation continued the fight. Not since the turn of the century had hydraulicking received such scrutiny, or as much active support.

By the early thirties economic conditions provided added force and a sense of immediacy to the cause of the supporters. A two-pronged attack was initiated, one supporting flood control and the other easing the unemployment problem. The solution to both difficulties, according to the mining interests, was the building of high dams.

As the economic crisis became more acute throughout the state, the voice of opposition became mitigated, and was finally overwhelmed. On the national level, Harry Englebright, Congressman from Nevada County, finally convinced Congress to aid in reviving the potentially profitable industry. In the summer of 1934 he was instrumental in securing an amendment to the Caminetti Act, allowing the construction of high dams, and on this occasion sufficient funds were appropriated to insure completion of the barriers. The federal government, in return, would be repaid by those using the dams.

> The individual, company, or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in whole or in part restrained by such dams . . . shall pay for each cubic yard mined from the natural bank a tax equal to the total capital cost to the dam, reservoir, and right of way divided by the total capacity of the reservoir . . .

In August of the next year Congress approved a project for the development of storage facilities on the Yuba, Bear, and American Rivers having a total estimated cost of roughly seven million dollars. Four dams were to be completed, two on the American and one each on the Bear and Yuba Rivers. Because of a landslide and generally unstable conditions of the site, the Ruck-A-Chucky Dam on the Middle Fork of the American was never completed. Henry Rich remembers the "Ruck-A-Chucky Gold Rush" . . . a slide from the abutment stopped the construction of this dam. After the slide some gold was discovered, and a rush was on, stopping everything temporarily until the gold fever was over with. I myself did pick up a few nuggets I found while doing some panning,

WALTER M. COFFEY

WALTER M. COFFEY
SACRAMENTO DISTRICT, 1917-1935.

Born 9 September 1890 at Santa Barbara, California. Received his BS in Civil Engineering from the University of California in 1916. Was appointed as a junior engineer in the Sacramento District on 15 October 1917. He was in charge of one of the three sub-districts of the Sacramento district from 1920 to 1935, with office headquarters at Stockton. During those years he was responsible for field supervision of all river and harbor maintenance and construction work on the San Joaquin River and its tributaries during his incumbancy, the preliminary surveys and the construction of the deep water navigation channel from Stockton to Suisun Bay were completed. Mr. Coffey retired from the federal service on 30 November 1935 and died in 1950.

and later discovered I had approximately $190." Moreover, construction of the Dog Bar Dam on the Bear was delayed and finally abandoned because of litigation that prohibited operation of the most valuable mines in the drainage area. The same act that adopted the project also stipulated

> that work shall not be begun on any reservoir until the repayment of the capital cost thereof by the payment of taxes on materials hydraulically mined from the natural bank . . . is assured to the satisfaction of the Secretary of War.

In addition to guaranteed repayment, the federal government required four other assurances: 1. That the gravels to be washed contained sufficient quantities of gold to justify mining, 2. That sufficient yardage existed, 3. That the owner had or could secure water supplies sufficient for operation, and 4. That the owner had sufficient financial resources to install the necessary equipment and hire the men to carry on operation.

Almost three years passed before the necessary guarantees were finally secured. In a letter to the California Debris Commission dated March 25, 1937, J.P. Hall, President of the California Hydraulic Mining Association, informed Major Harris, C.E., that "sufficient guarantees have been filed with the California Debris Commission to guarantee the construction of the North Fork Dam . . ." on the American River. Only thirteen days later, Congressman Englebright advised the miners that the guarantees and assurances had been accepted in Washington.

Two debris dams (and reservoirs), the Upper Narrows on the Yuba and the North Fork on the American, were completed prior to United States involvement in the Second World War. Both are units of the Sacramento River Debris Control Project authorized by the 1935 River and Harbor Act. After the War, in the fall of 1945 the Upper Narrows Dam was renamed the Harry L. Englebright Dam. By doing so Congress posthumously honored the man who had worked so hard to provide the means for rehabilitation of the hydraulic industry.

North Fork Dam, the first concrete arch dam built by the Corps of Engineers, is located on the North Fork of the American River about five miles northeast of the city of Auburn. The structure is 155 feet high and 620 feet long at the crest. Lake Clementine, the reservoir behind the dam, has a debris-storage capacity of approximately 26,000,000 cubic yards.

Englebright Dam is located on the Yuba River about twenty miles northeast of the city of Marysville. This arch structure is 260 feet high and 1,142 feet long at the crest. The reservoir has a debris-storage capacity of 118,000,000 cubic yards.

Over the years neither reservoir has been used extensively for debris storage. Why? Weren't these impressive, single arch, concrete monoliths designed to stimulate, reawaken, indeed rehabilitate the hydraulic mining industry? This final hope for renewed prosperity was doomed to failure before the first batch of concrete was poured. Conditions were so altered by the time of their completion that no amount of concrete could achieve the impossible. Besides, 19th century appliances seem strangely out of place in the 20th century world.

What was to have been the panacea for the hydraulic mining industry has in reality had little effect on gold production in the state. Triumph proved an empty victory; too little much too late. The world was a vastly different place in 1940 than during the last quarter of the nineteenth century. What would have been a godsend to the early pipemen and powder-monkeys, was just so much concrete to the men of the mid-twentieth century. The relative value of gold, the cost of operations, court battles with irrigation districts, the approaching spectre of war, the importance of Sierra waters for other than mining purposes — all of these factors, and more, made any idea of reviving the hydraulic mining industry an exercise in futility.

The controversy surrounding the debris dams was long from settled when Sacramento's Chamber of Commerce and its two major newspapers declared war on Col. Thomas H. Jackson, Division Engineer at San Francisco.

MEN WORKED HARD AND LONG DURING THE THIRTIES TO REINFORCE LEVEES ALONG THE SACRAMENTO AND SAN JOAQUIN RIVERS.
C.E. Photo

Sacramento City and the Central Valley, like the rest of the nation trying to endure the rigors of the Great Depression, coveted any project and was willing to defend any scheme that promised relief. Being an agricultural center, the Valley had suffered longer and to a greater extent than many other regions, and would not tolerate anyone or anything that stood in the way of recovery. They accused Col. Jackson of being such an obstacle. Let's review the evidence.

To prosper, a farming district must have adequate transport facilities to ensure successful distribution and marketing of its produce. For years residents of the Sacramento Valley were in large measure dependent upon the river to satisfy their needs. The agricultural depression beginning in the twenties and becoming a part of the general world-wide depression of the thirties, coupled with record low runoffs from the Sierra wrought a malicious circle which entrapped the local farmers.

Their efforts to offset tumbling prices by producing more resulted in consumptive use of the overtaxed available water, which lowered the river to where navigation was impaired, which in turn caused them to look elsewhere for carriers to distribute their goods. By utilizing trucks and trains to ship the bulk of their produce the farmers helped speed the demise of commercial navigation on the Sacramento River.

The city, dependent upon the prosperity of surrounding farms for much of its own, plucked the dropping banner from the farmers and made the agrarian cause its own. For, the number employed in Sacramento's canneries, food handling and processing was in direct proportion to the tonnage marketable. To these conditions one might add at least a portion of the 350,000 "Okies" and "Arkies" who in their jalopies migrated to California between 1934 and 1940. Displaced, like the dust responsible for their plight, these hard working men and women were seeking opportunities to fill their stomachs and restore their pride. The Chamber of Commerce of Sacramento believed they had hit upon a project that would provide social security to the residents of the Valley in the same way the debris dams would bring it to the mountain miners; a deep water ship channel to Sacramento was envisioned.

Their idea was neither novel nor unique, but given the severe conditions of the times, it was resurrected and embellished by the city fathers. The project was originally sponsored by the State of California and the Sacramento Chamber of Commerce in 1916. During the ensuing years the Sacramento City Council, the Sacramento County Board of Supervisors and the Yolo County Board of Supervisors had likewise sponsored the plan.

In October of 1916 the Chamber of Commerce convinced the state to appropriate $3,500 to be matched by the Chamber, for the purpose of making a study of the Sacramento River with a view of providing deep sea shipping at Sacramento. The survey was started, but slowed by World War I. Finally on October 7, 1922 Paul M. Norboe, Assistant State Engineer submitted his report recommending a deep water channel project.

The report was received, filed and forgotten. In 1924 the Sacramento City Council created a Deep Water Commission, which in turn hired C.E. Grunsky, a San Francisco engineer, to prepare a study. Grunsky's report was submitted in 1925, discussed, filed and ignored.

In October of 1933 the Sacramento Chamber of Commerce appealed to Senator Hiram Johnson for a survey to be completed by the Corps of Engineers. Soon thereafter the Senate passed Senate Resolution 142 requesting the Corps of Engineers to conduct such a study. Completed under the supervision of Captain Drinkwater, District Engineer for Sacramento, the unfavorable report was submitted to a special meeting of the Rivers and Harbors Committee by Col. Jackson in August of 1935. "The report contains a recommendation against a thirty-foot channel by Colonel T. H. Jackson of San Francisco." So stated the Sacramento *Bee* on August 22, 1935.

Not only did he feel a deep water ship channel for Sacramento was unwarranted, he also proposed changes in the flood control program on the Sacramento and San Joaquin Rivers. After studying the situation Jackson felt that

WHILE THE CONTROVERSY RAGED OVER DEBRIS DAMS AND DEEP WATER CHANNELS, SNAGGING OPERATIONS AND OTHER MAINTENANCE CHORES CONTINUED DURING THE 1930s.

new levees should be set back further from the rivers, and in some cases built higher. Further, he halted much of the levee work already approved until new plans could be drawn up. For holding such views Col. Jackson incurred the wrath of Sacramento's newspapers, whose attack upon him during the following years was as persistent as it was pitiless. Because he demanded a meeting with the State Reclamation Board be closed to the public, the *Bee* suggested that "Such tactics on his part can be interpreted by the public in only one way . . . there is a nigger in the woodpile he wants to keep covered up and is afraid to let the spotlight of public analysis shine on his proposed changes."

In another article it was pointed out that, "Sacramento, through the late Congressman Curry, had its flood control program adopted by Congress and the army engineers were detailed to help carry it out. Everything has proceeded smoothly until Colonel Jackson was placed in charge . . . The lives and property of valley residents are at stake where floods are concerned. Colonel Jackson and no one else must be permitted to interfere with the levee protection afforded the city and the lower valley." The *Bee* conceded the point that ". . . his engineering ideas may be sound and should have been included in the project originally," but argued, "this is no time, with the work almost completed, to impose new and costly burdens on the landowners." In the same article it was threatened, "If Jackson persists in his arbitrary attitude the Reclamation Board has no alternative but to go over his head and seek relief from his superiors in Washington."

During the week of September 22, 1935, the Chamber of Commerce learned of a trip to Washington planned by Colonel Jackson, and sent W.G. Stone racing off to the nation's capital "to present Sacramento's side of the case before Jackson can create an unfavorable at-

titude against the capital city with the Army Board of Engineers." The battle raged on. True to their threat those who opposed Jackson's views went over his head to General E.B. Markham, Chief of Engineers. Early in October General Markham came to San Francisco to effect a compromise between Jackson and his chief opponent, the State Reclamation Board. A.M. Barton, Chief Engineer of the Reclamation Board, and State Engineer Edward Hyatt, presented engineering objections to Colonel Jackson's proposals at a four-hour meeting with the General, while A.R. Gallaway, President of the Reclamation Board added that the plan couldn't be financed by the state and landowners.

After listening to both sides General Markham ordered briefs of the controversy be prepared and exchanged between Jackson and the Board, with the entire summation submitted to him. The General indicated he would have members of his staff arbitrate if a satisfactory compromise couldn't be effected.

Just after Thanksgiving 1935, General Markham sent Brigadier General George B. Pillsbury, Assistant Chief of the Corps of Engineers, to the Sacramento District for a first hand look at the problems. On the morning of December 3rd, General Pillsbury, in company with Col. Thomas Jackson, the Division Engineer; Col. L.B. Chambers, Sacramento District Engineer; Edward Hyatt, State Engineer

WORK CONTINUED ON STOCKTON CHANNEL THROUGHOUT THE GREAT DEPRESSION.
(Army Corps of Engineers Photo)

MOTOR LAUNCH *CALAVERAS*
July 1936
THE ONLY PRACTICAL METHOD OF TRAVELING THROUGH THE DELTA AREA DURING THE THIRTIES WAS BY SURVEY BOATS SUCH AS THE CALAVERAS.
(Army Corps of Engineers Photo)

DREDGES HARD AT WORK ON STOCKTON CHANNEL DURING THE EARLY THIRTIES.
(Army Corps of Engineers Photo)

and A.M. Barton of the State Reclamation Board, set out on an inspection tour of the levees between Sacramento and Colusa in an effort to gather information about the flood control project.

General Pillsbury spent two days checking the condition of the levees and listening to arguments. On December 5, 1935, he ordered the resumption of levee work on the Sacramento River. State officials hailed the ruling as a victory for more than eighty percent of the points involved. Off the record, state officials stated, "that if any levee breaks occur this winter, Colonel Jackson must assume the responsibility because of his action in holding up the work."

The *Bee* directed its attack mainly upon Jackson's ideas, but before long the *Sacramento Union* made it a personal vendetta. During the Spring of 1936 the following lines appeared in the *Union:*

> Colonel Thomas H. Jackson's name is anathema to the valley . . . (he) is an irritant and an expense to the valley. Instead of having to pass matters over his veto, why not remove him? It would save time, expense and constant irritation.
>
> It looks as if his attitude is one of studied unfriendliness to this section. It would be stretching human credulity too far to ask anyone here to believe Colonel Jackson is sincere in opposing every proposal looking toward the development of the valley section.
>
> It is time for the people to speak up. Their interests have been trampled upon, their requests for federal help have been scorned by an army man who is misfit in any system of civilian benefits contemplated by the government.

In a letter to the editor signed, "Sacramento Valley Property Holder" the writer congratulated the *Union's* editor for his attack upon Colonel Jackson and suggested that, "The local district engineer does exactly what he is told to do by Colonel Jackson." The writer then appealed to the *Union* to run an editorial entitled, "Show Some Guts, Colonel Chambers; Fight Jackson."

The rhetorical siege continued into the summer of 1936, when on July 20th Colonel Jackson requested retirement after forty-one years of active service. Who was this man who brought forth such invidious response from those who disagreed with him? Was he qualified to hold the views to which he clung?

Colonel Jackson had been active in flood control work in California since his first assignment in 1907, when as a captain he laid out the Sacramento Flood Control Project, a $50,000,000 project, begun in 1910 and more than 90% completed by 1936. During World War I he was in charge of the advanced section of the Corps of Engineers on the western front. He received the Distinguished Service Medal; the Purple Heart; Officer of the Legion of Honor, France; Commander of Leopold, Belgium; and the Polish Order of the Valiant, for his work as commander of the engineer forces in France.

Upon returning home to San Francisco in 1922, he served as Sixth Corps Area Engineer for six years. In 1928 he was appointed president of the Mississippi River Commission with the rank of brigadier general. Then it was back to San Francisco in 1934, when he was appointed Division Engineer. In addition to reviewing the needs of the Sacramento District, he personally directed plans for reclamation of Yerba Buena Shoals in San Francisco Bay, and for the Los Angeles County Flood Control Project. On September 1, 1936, Colonel Jackson was replaced as Division Engineer by Colonel John J. Kingman. W.G. Stone, traffic manager of the Sacramento Chamber of Commerce, who had raced to Washington, D.C. to present Sacramento's argument, later became Port Director of the Sacramento deep water facility.

Earlier General Markham said he was pleased that "all differences of opinion with regard to the completion of the Sacramento-San Joaquin River Flood Control Project have been settled amicably . . ."

Following a conference with state officials, the General issued the following statement: "I am very pleased indeed that we are now in full

COLONEL (THEN CAPT.) THOMAS H. JACKSON, DISTRICT ENGINEER, 3RD SAN FRANCISCO DISTRICT (FORERUNNER OF SACRAMENTO DISTRICT) FEBRUARY 1907 (Ca 1928).

accord with the state representatives so that the remaining work . . . may be vigorously prosecuted . . ." When asked to respond to the reports that Colonel Jackson would be transferred to another district, Markham said there was "nothing to" such rumors, but that the Colonel had not been in good health, further that he might resign because "he was a sick man." And so he did.

More than any other single event, the "Campaign to get Jackson" exemplified and, in fact, was a kind of microcosm which reflected the frustration experienced by those who suffered through the Depression. Desperate men employ desperate means to justify what they believe to be a good end, and those who made their homes in the Great Central Valley of California were not unlike the rest of the nation and the world when seeking answers or placing blame. No matter whether it be the voice of reason, reaction, radicalism or revolution, if it disagrees with, or is viewed as a hindrance to, the hoped for solution, it is turned aside or attacked.

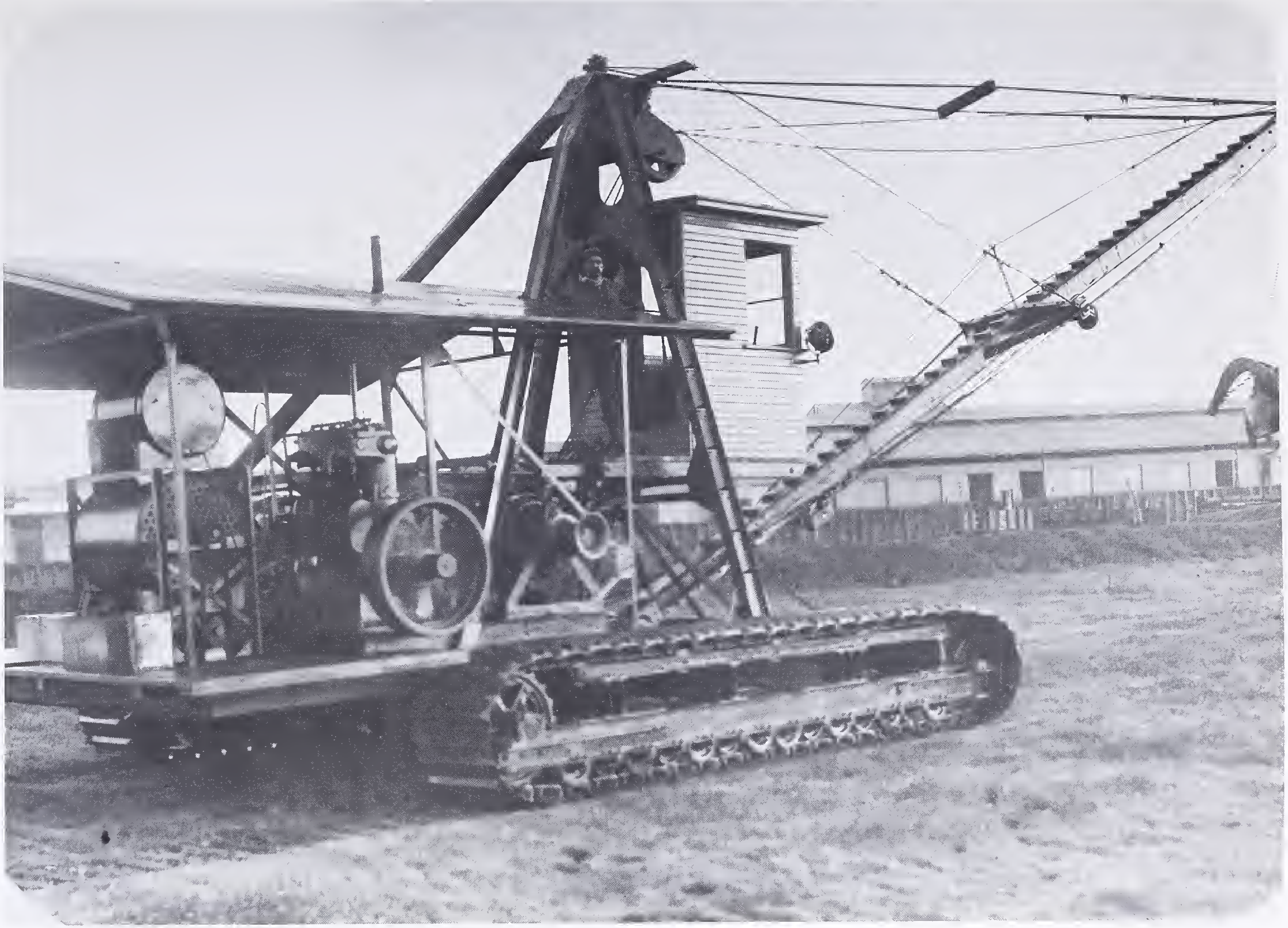
The historian, David Shannon, brings the local conflict into focus, and places it in proper perspective in his commentary about the period:

> The apostle Luke wrote that man does not live by bread alone. Few would question, however, the fact that the availability of bread and the way man earns it have tremendous implications for his society. In the 1930's the availability of bread was very much on men's minds, and economic distress colored American society in many of its noneconomic aspects, both obviously and subtly. The fundamental assumptions Americans made about their society, the manner in which they educated their young, what they did in their leisure time, even how many they were and where they were, were all fundamentally affected by the overriding omnipresent, dismal economic situation.

A group of Iowa farmers expressed themselves in more condensed fashion when they protested: "In Hoover we trusted, now we are busted." and "Hoover, Hyde, Hill and Hard Times."

The point is, those who resided within the Sacramento District weren't alone nor unique in their distress. While Valley people battled for debris dams, levees, deep water channels (for both Sacramento and Stockton) and anything else that could be translated into work, food and restored pride, the rest of the nation fought for or against T.V.A., socialism, communism, the Supreme Court, the New Deal, organized labor, tariffs, Negroes and the Bonus Expeditionary Force. Most Americans, it's true, agree with Jefferson's sage advice that, "Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shown, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed." During the depths of the Depression, there was a question throughout the Valley and the Nation as to how long some evils were sufferable, and what were light and transient causes. Revolution, both economic and political, then, presented itself as a possible way out of the dilemma.

In the end it was neither Roosevelt's manifold alphabet agencies, nor public works projects, nor pork barrel legislative make-work programs, that brought an end to economic disaster and possible revolution. Somber events and evil schemes transpiring in Germany, Japan, Poland, Czechoslavakia and Pearl Harbor, in the final analysis, proved to be the catalyst for recovery within the Sacramento District and the Nation. It is paradoxical that the frustration, defeatism and hatred spawned by the Depression, in large measure were responsible for the worldwide cataclysm which eventually brought prosperity to the United States.



EQUIPMENT SUCH AS THIS HELPED MAINTAIN THE INTEGRITY OF DISTRICT LEVEES DURING THE PERIOD BETWEEN THE WARS.
(Army Corps of Engineers Photo)

COLONEL ROBERT C. HUNTER
SACRAMENTO DISTRICT ENGINEER — NOVEMBER 1940 — DECEMBER 1944
C.E. Photo

It is difficult to find a parallel to the unwisdom of the British and weakness of the French Governments, who nonetheless reflected the opinion of their Parliaments in this disastrous period. Nor can the United States escape the censure of history. Absorbed in their own affairs and all the abounding interests, activities, and accidents of a free community, they simply gaped at the vast changes which were taking place in Europe, and imagined they were no concern of theirs . . .

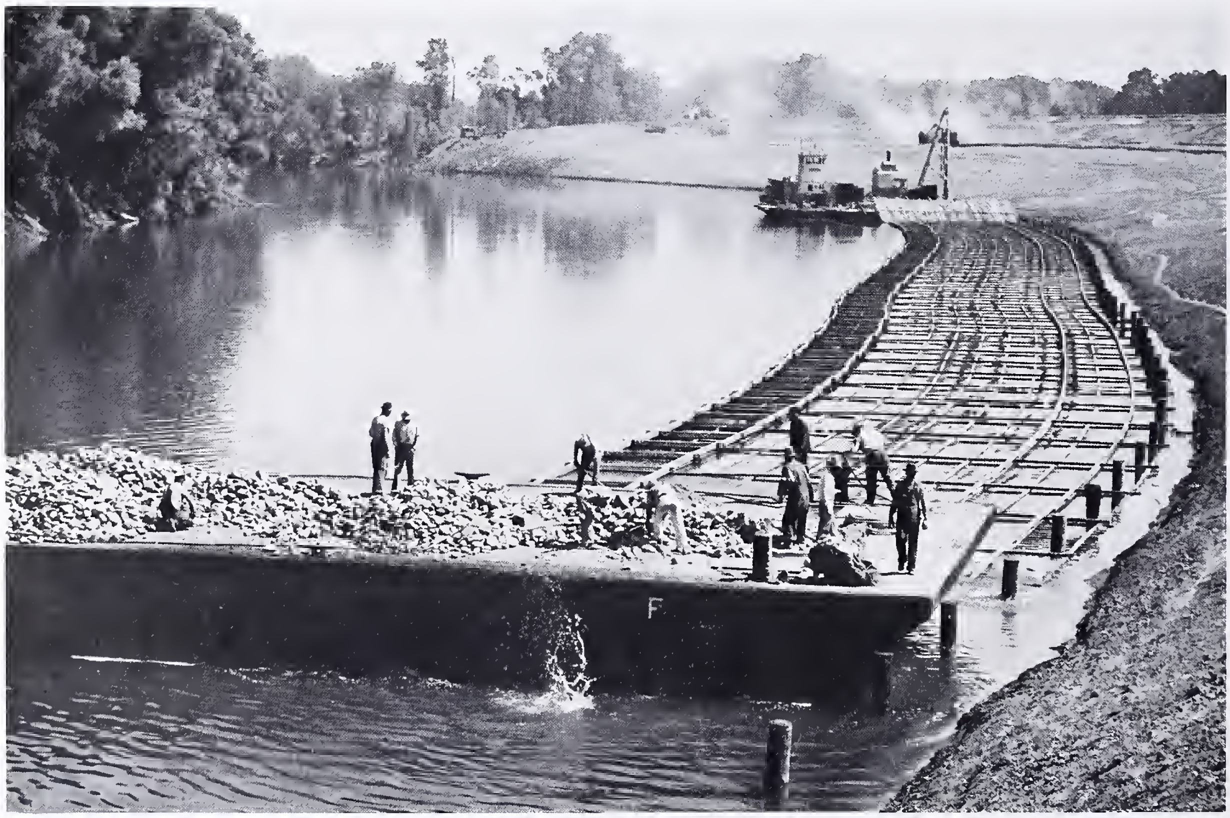
. . . so in a few years they had to pour out the blood and treasures of the New World to save themselves from mortal danger.

Winston S. Churchill

CHAPTER V
IN WAR: RESOLUTION

As the war clouds darkened and the world scene grew cheerless, the United States began tooling up for conflict. As part of the general preparedness schedule, all construction of Army Air Corps facilities was transferred from the Quartermaster Corps to the Corps of Engineers by act of Congress effective November 20, 1940. With the attack on Pearl Harbor as the catalyst, construction for the remainder of the Army was charged to the Corps of Engineers on December 16, 1941.

Construction responsibilities being transferred to the Engineers was no reflection on the other services, but was necessitated by expediency. The urgent and almost overwhelming construction job thrust upon the nation de-



WOVEN LUMBER MATTRESSES, MANUFACTURED AT THE SITE AND HELD IN PLACE BY COBBLES, WERE USED EXTENSIVELY FOR BANK PROTECTION PRIOR TO THE WAR. THIS TYPE OF ACTIVITY WAS GREATLY CURTAILED DURING WORLD WAR II.
C.E. Photo

manded mobilization on a wartime footing. The Corps of Engineers was the country's only existing agency, either civil or military, that could readily meet the multiple demands of such a job.

The immensity of the task and the efficiency with which it was executed are reflected in the following figures: From the beginning of 1940 to the end of 1945, in the United States alone, some 3,000 command installations, 300 major industrial projects and hundreds of miscellaneous facilities were completed. Included in the above were 500 camps, 765 airfields, 167 storage depots, and numerous training schools, ports of embarkation, hospitals, and other facilities. During the war years approximately $11,000,000,000 worth of construction was completed by the Corps of Engineers in the United States. By the summer of 1942 the Corps of Engineers was directing construction activities in this country at the rate of $20,000,000 a day (nationwide expenditures). Because of its geography and talented citizens the Sacramento District was awarded a substantial percentage of the tasks to be fulfilled.

Henry Rich described the prewar scene and compared it to the first days after Pearl Harbor. Before the war, "things were rather peaceful, and we had about 300 employees, counting everyone in the main office, plus all field personnel and maybe counting a couple of cats in the warehouse at Rio Vista."

During 1940 and following the transfer of Army Air Corps facilities late that year, and due to the ominous world conditions of 1941 the District had grown to about 600 people. By the end of 1942 more than 2,000 would be sharing the workload of the District.

Mr. Rich stated that, "Come war time in 1941 the office was moved from the Post Office Building to the Wright Building at 8th and L Streets. It seemed everything was dumped into the District's lap, and we started to grow and grow and grow, with offices in six other buildings in Sacramento, plus six large field offices. They were located at Rio Vista, Marysville, Stockton, Fresno, Bakersfield and Reno. Later we opened an office at Salt Lake City."

Col. Hunter, in keeping with the national policy of limiting wartime construction projects on rivers and harbors to improvements that had direct importance for the war effort, cut the civil works mission of the District to a bare minimum. Earlier it had been anticipated that the major work of the District during 1941 and 1942 would be in connection with the Sacramento River Flood Control project and the completion of the debris dams. Dredging below Cache Slough and construction of levees on the Sacramento and Feather Rivers, together with work in the Delta were all planned. Such was not to be the case. Only the most essential maintenance was prosecuted during the war years.

Mrs. Marion Morton relates her feelings regarding the District's change of direction. "The transition from civil to wartime military construction was to me a marvelous adaptation. Inspectors and workers on earthwork and hydraulic jobs found themselves on-the-job learners of building and paving. Because of the pressures of wartime needs, they soon became seasoned and experienced. When the unfamiliar functions were transferred from the Quartermaster Corps, they were somehow assimilated, and made to produce the results intended."

At the time military design and construction functions were assigned to the Sacramento District in 1941, its military boundaries comprised the Central Valley of California from Kern County in the south to Shasta County in the north. During 1942, Reno Army Air Field (Stead Air Force Base), Nevada, was included within the District.

In those hectic days following Pearl Harbor, the increase in volume and variety of work was met with added resolution and vigor, the sneak attack providing the necessary stimulus, if such were needed. The tremendous expansion of construction work, even though accompanied by a significant increase in total personnel employed by the District, was marked by a corresponding decrease in cost of overhead. Every possible means was utilized to diminish the number of steps necessary to prepare plans and specifications. Office staff as well as field personnel worked long hours to such good purpose that eventually the cost of

District overhead, including consulting and architect engineers, fell to less than 2% of the cost of work placed. But, even with the confusion and flurry of activity present at the time there was no disposition to lose sight of the fact that those needed at the fighting fronts must not be retained on construction work when others could replace them. By the end of 1943 more than 500 men and women formerly employed by the Sacramento District were in the uniforms of the various Armed Services. Some paid the supreme price and would never return to their desks and dredgers of the District.

Jim Coombs, at that time Assistant Chief of Electrical Section, comments on the above. "During World War II, the Sacramento District did a great job preparing the plans and specifications and overseeing the construction of millions of dollars of work. Somewhere in the District's files is an indication that we had the lowest district costs for the work produced in the country." To be exact, it wasn't long before the Sacramento District was building at the rate of $20,000,000 a month.

The construction work assumed by the District after December 1941 involved a variety and magnitude that in retrospect it is difficult to believe that it was all accomplished. One of the initial assignments was to prepare temporary housing for 37,000 Japanese Americans who were ordered from their homes, farms and businesses.

As early as 1886, when there were only 400 Japanese in the entire state of California, the slogan "The Japs Must Go" was first voiced. Even in 1941 residents still harbored a remembrance of the long and bitter contest for Chinese exclusion, and many of the arguments that had been employed against the Celestials seemed equally applicable against the Nipponese, who by pigment, stature, language, and customs resembled the former. While making up barely more than one percent of the state's population, they were seen as a "clear and present" danger.

Against the background of the attacks on Pearl Harbor, the Philippines and Guam, the horror-fiction anecdotes that circulated widely as to what the Japanese Americans would do if war came assumed believable proportions. Officially admitted losses were high; rumor multiplied them. Many residents of the Pacific Coast believed that, with the Pacific fleet destroyed, the west coast was vulnerable to attack.

Jack English related the following incident, which helps us understand the concern of the time.

> That was quite a trip. We followed the southern route through New Orleans, across Texas and Arizona to Blythe where we entered California, for it was still winter on the northern routes. We noticed as we passed through the open spaces of Arizona that we were practically the only car travelling West, with comparatively heavy traffic toward the East. At one stop I was asked if I didn't know that the Japanese might be coming?

To Lieutenant General John L. DeWitt, Commanding General of Western Defense, "A Jap's a Jap. It makes no difference whether he is an American or not."

The General was not alone in his feelings. Throughout the western states the majority of residents demanded that every Japanese be evacuated from the coastal areas. For some time, however, Washington was reluctant to adopt a policy of mass evacuation and internment. It seems that when the respected correspondent Walter Lippmann added his voice in protest, President Roosevelt changed his mind. On February 12, 1942, Lippman stated that, "The Pacific Coast is officially a combat zone: some part of it may at any moment be a battlefield. Nobody's constitutional rights include the right to reside and do business on a battlefield." Only five days later President Roosevelt signed Executive Order No. 9066, which authorized the Secretary of War to establish military areas from which any and all persons might be excluded. The exclusion order was immediately effected, and with brutal disregard the entire Japanese American community of the West, more than 100,000, were driven from their homes.

The engineers of the Sacramento District

were assigned the task of housing more than a third of the displaced. Having but a few days to secure shelter, any vacant dwelling, however rude, was pressed into service to serve as gathering and sorting places. Warehouses, fairgrounds, and even horse barns were used as temporary homes. Camp Kohler adjacent to McClellan Field, one of the first military construction jobs completed by the Sacramento District, came into being first as a Japanese induction center and was later used as an army base. Other alien induction centers were hurriedly built at Fresno, Marysville, Merced, Pinedale, Stockton, Tulare, Turlock and Walerga. Within a few weeks from the date of receiving the unpleasant assignment, Sacramento District personnel had constructed housing for approximately 37,000 Japanese Americans, at a cost of almost five million dollars. Considering the time constraint and the shortage of labor and materials, the job was completed quite satisfactorily.

In time, the War Relocation Authority took over internment responsibility from the Army and selected ten sites on which to construct relocation centers of a more permanent nature. All the camps were located in desolate areas and built on federally owned land — usually Indian reservations. The Sacramento District also helped in the construction of these. Life in the great sprawling camps, including Manzanar and Tule Lake in California and Abraham in Utah, constituted a sociological laboratory. Occupants divided themselves into two groups, those which accepted the predicament and tried to make the best of it, and another, smaller, which rebelled at the treatment and bitterly opposed the camp administrators.

The American public too, after the initial flush of war panic had cooled, reconsidered the evacuation and internment of American citizens, and became sharply divided as to the wisdom, necessity and merit of the action. Finally in December 1944, the evacuation orders were rescinded, but by then a third of the Japanese had moved eastward to communities outside the exclusion areas or had entered the armed services. By 1945, the population in the camps had dwindled to about 62,000.

From the above, it is obvious that both the civilian and military authorities considered the Second World War as being a direct threat to the West Coast. And until 1943, when the direction of war changed in the Pacific, the prospect of hostilities within the boundaries of the Sacramento District was a vital factor in the plans and functions of the District.

For the first three months of 1942, the District personnel engaged in organizing and implementing their military construction mission. Even for the Corps of Engineers, it takes a little time to change gears and prepare for new roles. We are reminded that California contained more than ten percent of the troop training centers of the nation during the War. The area was also the principal staging area for the Pacific campaign. In addition, the Air Corps required scores of flight strips and associated facilities, many of which were built in and by the Sacramento District. Moreover, ordinance, holding and reconsignment, and quartermaster depots and storage areas were built, all in record time.

The main work, then, of the Sacramento District during the war was to seek out suitable areas for military bases, both Army and Air Corps, throughout the Great Central Valley of California and construct needed appliances to ensure the success of the war effort. As the war continued, the District would be expanded to take in large sections of other western states. We can never know the full extent of the District's wartime activities because many of the records have been lost, or thought not important enough to file in the first place. Enough has survived, however, to furnish us with at least a partial view of the events that transpired during that critical period.

A few days following Pearl Harbor, a directive was issued for construction of a staging area to house 28,000 men near Pittsburg (California). Normally, weeks would be necessary for the preparation of plans and specifications, and for the acquisition of the real estate for this kind of project. Within eight days, the work to be done was outlined, and ninety days later Camp Stoneman was ready for sol-

DELTA QUEEN
(Photo Sam Kahiona)

diers on their way to the Pacific. In addition to the troop housing, the waterfront area had to be dredged to afford deep water vessels berthing space. Soon the *Sacramento* and *San Joaquin*, the familiar dredges of the District, were hard at it, displacing thousands of cubic yards of mud.

Two other well known river craft, the *Delta King* and *Delta Queen,* were utilized at Camp Stoneman. No longer would they take pleasure seekers up and down the inland waterways of California, but aided the war effort by ferrying troops from Stoneman to San Francisco to board ships for the Far East.

The dredges themselves went on to help win the war after they finished their duties in the District. The *Sacramento* was transferred to Midway Island, where it dredged a channel, and then moved on to Johnson Island. While there, a Japanese submarine took a few pot shots at it, so that when it finally got home, a couple of "wound stripes" decorated the stack.

Henry Rich recalls that, "most of the supplies, while the dredges were in the South Pacific, were furnished by the District Office. Almost every other night around 10:00 P.M. our time, we talked to the crew and took their order for what supplies and parts were needed."

The *Sacramento* worked as far west as Okinawa. After the war the *Sacramento* and *San Joaquin* were brought home to continue their work on the flood control projects on the rivers for which they were named.

While the dredges were off to the South Pacific and construction was underway at Pittsburg, Sacramento District personnel began building Camp Beale, near Marysville. All the facilities for a city of 43,000 troops had to be provided. Barracks, dispensaries, a hospital, fire station, mess halls, a chapel, laundries and scores of other kinds of housing and services were provided.

Many and varied units made use of the facilities while being trained at Camp Beale. Infantry, tank crews, engineers and various other types of commands learned the deadly skills needed to combat the enemy. The 13th

Armored Division was the first unit to actively train at the base, followed by many other units, including the 81st and 96th Infantry Divisions. After leaving Beale the men of the 13th Armored would fight and die in the Ruhr pocket, at Regensburg and along the Danube and Isar Rivers. The "Wildcats" of the 81st met the enemy at Angour, Peleliu and Ulithi while the 96th helped take Leyte and Okinawa. Some of Patton's men also trained at Beale before going off to Africa and Europe.

Before long, the Sacramento District was furiously building cantonments, storage depots and even hospitals all over the Central Valley. Near Stockton, they were turning a Portuguese farmer's sheep pasture into the Stockton General Depot. It became a fair-sized city that repaired, maintained and supplied an endless variety of war material to all parts of the globe, especially the Pacific area. At its wartime peak the installation was capable of loading 6,000 rail cars of supplies and equipment a month. Besides this huge supply depot, the Engineers from Sacramento put up a multitude of similar projects in the Northern San Joaquin Valley: Stockton Quartermaster Motor Depot; Tracy Sub-Depot; Lathrop Army Service Forces Depot; Stockton Ordnance Motor Base; Lathrop Engineer Depot; Lathrop Holding and Reconsignment Depot; were typical of the support facilities constructed by the District in the Stockton area.

In the Sacramento area, the District engineers constructed Camp Kohler. Additional Army projects completed in the Sacramento area included the Army Signal Depot; The Bercut-Richards Warehouse; and a camouflage center. The State Fairgrounds were even utilized for military purposes. To facilitate the transportation of troops and supplies, the District spent a million and a half dollars during 1942 and 1943 modifying railroad classification yards at Lathrop, Riverbank, Roseville, Stockton and Sacramento.

The Central Valley was not the only area that received immediate attention regarding construction for the Army. In 1940 Colonel Carroll H. Deitrick was sent in search of a behind-the-lines storage facility. "We tried to find a site nearer a large city . . . We spent many weeks searching for a place which would meet all the requirements. The desire was to have it as close as practicable to the west coast and still keep a safe distance from the sea." High in the Sierra, just north of the small town of Doyle, he spied the vast, uncluttered expanse of Honey Lake Valley. Years later, in recalling his decision to recommend the area for the ordnance depot, he admitted, ". . . not one bit of consideration was given to the comfort and convenience of anyone who was supposed to man and operate this place. At the time, such things were secondary. The winning of a war was of number one importance."

During 1941 the Army took action to establish its new base. The area selected was about mid-way between Susanville and Reno. Construction was underway just five days after the War Department, in General Order Number 9, dated February 5, 1942, designated the site, Sierra Ordnance Depot. Before long the District engineers were constructing housing and mess halls for the workers. Jo Iland, in her excellent history of the Depot, points out the sad plight of the contractors in converting the desert into a storage depot. "So acute were the contractor's labor problems that any and all comers were hired. The riff-raff of western cities came to the isolated location which was a harbor for fugitives from justice and those individuals down on their luck."

The base, in addition to its role as an ammunition storage area, served as a troop training facility. Moreover, Italian prisoners of war were kept there, and never failed to share many colorful experiences with their keepers. On April 2, 1943, a seventy-two bed hospital was authorized, and by September it was ready for use. Once again, whether on the floor of the Central Valley or high in the Sierra, the Sacramento District engineers performed their assigned tasks excellently. Sierra Ordnance Depot serves as a good example. Within a few months they had transformed a high mountain desert into a facility that loaded 3,000 rail cars a month with bombs and munitions to stop the enemy.

Training and storage bases, of course, were

only a part of the District's projects completed in California during the war years. Housing was needed for prisoners of war. During 1944 and 1945 Sacramento personnel constructed detention camps at Tagus Ranch, Stockton and Pittsburg. At Byron Hot Springs, an existing hotel was reconstructed at a cost of $215,000, and used as an interrogation center. To speed the military manpower buildup needed to prosecute the war, the District, in September of 1942, constructed Army induction stations at Sacramento and Fresno. And to provide care for our fighting men wounded on the fighting fronts, hospitals were built at Auburn and Modesto.

While hundreds of men and women of the District's work force busied themselves with the design and construction of supply bases, storage depots, hospitals, internment camps and the myriad army facilities, hundreds of others were actively engaged in what proved to be Sacramento's major assignment: airfield site selection, design and construction, initially within California and later in other western states. Almost fifty major and minor Air Corps bases were either partially or completely constructed by the Sacramento District within California alone.

Soon after the Corps of Engineers received responsibility for Air Corps construction in the fall of 1940, the Sacramento District began work on projects "inherited" from the Quartermaster Corps. Early in 1941 improvements were being made at Mather Field and Sacramento Air Depot, both of which are located near the state capital.

First activated in the summer of 1918, Mather Field (Air Force Base) is among the oldest military installations in the Sacramento District. Little used between the wars, the base was reactivated and completely rebuilt by the Sacramento District early in 1941. During World War II it became one of the major flight training schools in the nation. By the time it was turned over to the Air Transport Command in October 1944, Mather had graduated 3,875 pilots and 3,200 navigators who saw action in every combat area of the globe.

For more than a year the base served as the "Gateway to the Pacific." From runways built by Sacramento Engineers, combat crews and aircraft lifted off for the war against Japan. Almost the entire fleet of B-29 Superfortresses employed in the Pacific Theater left from Mather. Millions of dollars were spent not only on extensive runways, but on housing, hospitals, stores and every conceivable appliance and utility needed on the greatly enlarged base.

Concurrent with the work at Mather, the District quickly enlarged the Sacramento Air Depot (McClellan Air Force Base). Haven Hart described the way things were done in the very early days of military construction. "An example of the lack of experience in military construction was the mess hall at McClellan. Engineers simply found a mess sergeant and asked him how he thought the facility should be laid out. When completed everyone thought the mess hall was well designed."

Sacramento Air Depot also traces its lineage to the earliest days of flying. The base descended directly from Rockwell Air Depot which was established in 1912 as the Army's first regularly organized school of aviation, on North Island in San Diego Harbor. By the early thirties, the depot had outgrown its facilities on the island, and largely through the efforts of Arthur Dudley of the Sacramento Chamber of Commerce, the base was moved to the old Mexican land grant, Rancho Del Paso, near Sacramento. The depot became fully operational on March 2, 1939. Only a few days earlier, more than 50,000 people had attended the dedication ceremonies. General George C. Marshall, General Henry H. (Hap) Arnold, Senator Hiram Johnson and Colonel Carl Spaatz were among the dignitaries present. On December 1, 1939, the War Department selected the name McClellan Field for the military reservation of which the Sacramento Air Depot was a part.

Even though the Sacramento District was enlarging and improving the base prior to our involvement in the War, new construction really mushroomed following the news of Pearl Harbor. Runways, warehouses, mess halls, barracks, offices, utilities, roads and other nec-

MCCLELLAN AIR FORCE BASE (Ca 1967)
(Army Corps of Engineers Photo)

essary facilities were quickly provided. Many were finished just in the nick of time to take part in one of the War's most guarded operations.

Not since the Revolutionary War had the United States suffered losses such as experienced at Pearl Harbor and Bataan. "Remember Pearl Harbor" became the rallying cry for the nation in a year of unparalleled defeats. To counteract defeatism and lift American hopes, a daring raid was planned on Japan's heartland. Led by Lt. Col. James H. Doolittle, twenty-two B-25 bombers began landing at Sacramento Air Depot on March 26, 1942. Here the aircraft underwent final inspection and repair. Each of the planes was fitted with new propellers, a sixty gallon gas tank was placed into the lower gun turret, and a camera installed on board each aircraft. Following other minor modifications and a thorough going over, the raiders lifted off Sacramento Air Depot's flight strip on April Fool's Day, 1942. Eighteen days later Colonel Doolittle, with sixteen of the B-25's and 79 pilots and crewmen, left the tossing deck of the aircraft carrier Hornet 688 miles from Tokyo. Thirteen of the planes unloaded their quarter ton bombs on Tokyo. Two hit targets in Nagoya while a single aircraft bombed Kobe. Of the men that left McClellan, most were imprisoned by the enemy, three were shot. Of the total, nine died. One of the planes crash landed near Vladivos-

tok and was interned by the Russians, never to be returned. The crew escaped to Iran.

Meanwhile, building continued at the base. The shortage of troop housing facilities reached critical proportions, prompting the building of two and one-half million dollars worth of housing on some 118 acres of recently leased land. Officially the acreage was designated "Troop Area," but in the vernacular of the day it was "Splinter City."

Staggering as its responsibility was for supply, repair and maintenance, Sacramento Air Depot under a Colonel Clark, took on supervision of many other air depots throughout the Sacramento District. Due to the increasing tempo of the war in Europe and the sword rattling of Japan, Headquarters Army Air Corps activated five sub-depots under Sacramento Air Depot's supervision during August of 1941. In November, three other sub-depots were added, and early in 1942, ten more were being supervised by Colonel Clark. In May, Colonel Clark was appointed Commander of the 4th Air Service Area Command with headquarters in San Francisco. On July 6, 1942, 4th Air Service Area Command headquarters was moved to Sacramento, and it was here, then, that the principles and practices of coordinated logistics were worked out.

The increased Air Corps activity was reflected by the greatly expanded program of air field construction by the Sacramento District Corps of Engineers. Before the war, there were few air fields in the West, and those that were here were usually very small and not adequate for military purposes. Before long, just as with Army bases and supply centers, the Sacramento District had two score of air bases under construction from one end of the Valley to the other. Basic flying and pilot schools were built at Chico, Lemoore, Mather, Minter and Merced Fields. Runways, taxiways, hangars, housing, barracks for troops, male as well as female, and whatever other support systems unique to a given base, were put up without delay. The following is a list of the major and auxiliary Air Corps facilities located with the Sacramento District (California) during the war: (See Map)

1. Redding Army Air Field
2. Vina Auxiliary Field
3. Campbell Auxiliary Field
4. Kirkwood Auxiliary Field
5. Chico Army Air Field
6. Orland Auxiliary Field
7. Oroville Army Air Field
8. Marysville Army Air Field
9. Sacramento Air Depot
10. Lincoln Auxiliary Field
11. Winters-Davis Flight Strip
12. Mather Field
13. Sacramento Municipal Airport
14. Fairfield-Suisun Airport
15. Franklin Auxiliary Field
16. Kingsbury Auxiliary Field
17. Concord Army Air Field
18. Stockton Field
19. Tracy Auxiliary Field
20. New Jerusalem Auxiliary Field
21. Mariposa Auxiliary Field
22. Modesto Auxiliary Field
23. Merced Army Air Field
24. Merced Auxiliary Field
25. Ballico Auxiliary Field
26. Merced Municipal Field
27. Athlone Auxiliary Field
28. Hammer Field Army Air Base
29. Lemoore Army Air Field
30. Helm Auxiliary Field
31. West Auxiliary Field
32. Huron Auxiliary Field
33. Indian Auxiliary Field
34. Murray Auxiliary Field
35. Visalia Army Air Field
36. Porterville Army Air Field
37. Delano Army Airdrome
38. Dunlap Auxiliary Field
39. Fomosa Auxiliary Field
40. Minter Field
41. Oildale Army Airdrome
42. Pond Auxiliary Field
43. Semi-Tropic Auxiliary Field
44. Gardner Field
45. Allen Auxiliary Field
46. Kern Auxiliary Field
47. Parker Auxiliary Field

Building, extending and improving runways was not enough. The planes that used them

had to be protected as well. The Corps of Engineers provided security for aircraft, especially fighters, by building revetments at major Air Corps installations. Mound-shaped revetments were three-sided rectangular, roofless structures made of pilings, earth and usually surfaced with asphalt. Netting and camouflage was suspended over the top, hopefully concealing the plane from enemy bombers. Henderson McGee, in recalling protective measures utilized during the war years, indicated that while fighters were hidden by revetments, airfield water towers got the "chicken feather camouflage" treatment. Not strong perhaps, but it helped the structures blend into the surrounding landscape.

In the early days of the airfield construction program, very little was known of design criteria for runway pavements meant to support the loads of the moderately heavy planes then being used, or for the B-29s then undergoing development. Determining correct design criteria proved to be among the most difficult and important technical missions accomplished by the Corps of Engineers during the war years.

The extent of the problem first came to light in the spring of 1941 when the 160,000 pound XB-19 was pulled from the Douglas hanger at Santa Monica on May 6th. The huge airship broke through the apron and caused considerable damage to the asphalt runways. If an empty B-19 caused damage to a dry runway, it wasn't difficult to calculate the problems associated with fully-loaded planes landing on rain-soaked fields. A technical barrier had been reached. Before long, however, the engineers of the Sacramento District were deeply involved in studies that would eventually surmount the barrier.

The weeks following the attack on Pearl Harbor witnessed a crushing load being placed on airfields within the District. In an effort to reinforce General Douglas MacArthur, General Arnold ordered every available B-17 to be flown to the Pacific war zone at the earliest opportunity. Soon thereafter scores of the Flying Fortresses were giving the airstrips at Mather and McClellan a cruel pounding. Construction and repair crews had to work around the clock to keep the fields operational. Considering the fact that a B-17 weighs only about half as much as a B-29, the future appeared bleak indeed.

Clearly superbombers would require runways that were longer, wider and stronger than ever before. General Arnold's plans called for carrying the war to the enemy by way of heavy, long-range bombers.

For some time Colonel Hunter had been working with James Porter of the California Division of Highways and Lt. Col. John Colonna, the Fourth Air Force Engineer, on plans for District constructed flight strips. Porter, as a junior engineer for the Division of Highways, had investigated pavement failures throughout California, and decided that porous, loosely compacted soil used in roadbeds was the major problem. After having studied the problem he devised a procedure known as the California Bearing Ratio test, to measure shear resistance of base and subbase materials. In time he formulated curves that would show the relationship between bearing ratios and pavement thickness for wheel loads up to six tons. Given an opportunity to apply his findings and techniques to runway construction, he conducted tests at Stockton Air Base. Constructed by the city in 1936, the runway had been torn up during the winter of 1940-41 by relatively light Army trainers. A nearby taxiway laid down at the same time was still intact. Porter planned to make tests on the taxiway as it existed, and on a special area rebuilt for his purposes. Hopefully he could validate his theories and his unique process. Colonel Hunter provided complete engineering support for the project and soon Porter, with Sacramento District cooperation, demonstrated that his theories were very close to being correct when applied to real conditions. While it wasn't the whole answer to airport construction problems, it proved to be the breakthrough that showed the way for future design. The Sacramento District was the first in the Corps to make use of Porter's California Bearing Ratio in the design and construction of flexible pavements. Later, the Office, Chief of Engineers (OCE) adopted it as

the standard for the entire Corps.

In addition to putting their skills to the test within California, Sacramento personnel were called upon to complete an air base in the Pacific Northwest. The work at Ephrata, Washington, had fallen far behind schedule, and even though outside the District, the completion of the job was turned over to Sacramento to expedite by every means possible. Key personnel were sent to Ephrata to reorganize the work in cooperation with contractors who had demonstrated an eagerness and ability to overcome obstacles. Sacramento men spent $500,000 and five weeks in completing the airstrip. Upon completion, it was used by hundreds of bomber crews to gain the necessary skills to bring the war to Japan's home islands and German factories. Frank L. Waddock, long-time District employee, stated that the Ephrata work was, "One of the outstanding jobs the District accomplished . . . during World War II . . . The know-how of designers and construction men in the Sacramento District succeeded in providing adequate airfield pavement for the Flying Fortresses — the first step into the Pacific Area in support of our armed forces."

Those who had gone to Ephrata were just preparing to return home after their blitz when a second one appeared. Tonopah Bombing and Gunnery Range in Nevada was to be expanded, the runways extended, and new taxiways and parking aprons to be built. The time allowed to plan the work, mobilize construction equipment and personnel was a little over six weeks. All this was to be accomplished in the middle of a desert 400 miles from Sacramento. The existing water supply furnished but 20 percent of the daily requirements. Jack English gives us some insight into this particular project.

> One situation . . . which greatly impressed me was in connection with the huge expansion of the Tonopah Army Airfield out in Central Nevada way back in 1943, which entailed eight million dollars worth of construction in a very few weeks. This project was of vital importance to the Fourth Air Force, so much so that upon receipt of the authorizing directive, a briefing meeting was held in the District Engineer's office for personnel involved in this project. (I was liaison engineer assigned to that installation.) The Commanding General of the Fourth Air Force, Major General Lynd, a very tough, much decorated soldier, outlined in no uncertain terms just what was expected of the Corps . . . some of his remarks to say the least were *not very* complimentary. (I think all those present were seething at his words.) At the conclusion of his talk, Colonel R.C. Hunter, our truly wonderful wartime District Engineer arose to his feet, looked the General directly in the eyes and said *in no uncertain terms,* "General, now if you can *act* as tough as you *talk* I will guarantee you the project will be completed and turned over to you for its mission, *on time.*" Momentarily he appeared somewhat taken aback, then said "Alright, Colonel, what do you want me to do?" The answer was "Call up Washington and get me authority for a free hand to accomplish this project without interference." The call was immediately made and completed. The General turned to Colonel Hunter, informed him that the required authority was granted, and would immediately be confirmed. Colonel Hunter thanked the General again, *assured* him that the project would be completed on time, then turned to all present and said, "You all know what is required, now get going!" (*Believe me we did*!) To cut a long story short, we lived through some of the most hectic weeks of our careers, but the job was completed ahead of schedule. The District received a letter of commendation from the above-cited General. Not only did he do that, but he attended a luncheon meeting of the Sacramento Section, American Society of Civil Engineers, (many of us were members) where he again congratulated Col. Hunter and the District, upon the job we had performed. He also said that it was the first time in his career he had

ever commended the Engineers. He was most gracious and fulsome in his praise. Believe me it was worth all the hardship of those hectic days.

An interesting point about the expansion of this project was that its mission was very secret. I was at Post Headquarters for some days working out layouts for expansion with the Post Commander, but at no time was I allowed to inform him of what particular mission all the hectic urgency was about. I remember calling the Liaison Officer at Headquarters Fourth Air Force, and pointing out to him the embarrassment and difficulty connected with such a situation. My answer was definite . . . "too bad, work it out the best you can, but any information regarding the type of aircraft for which this huge expansion is authorized is *strictly taboo*!!" As usual I obeyed the last order and accomplished my assigned mission to the best of my ability; however, it was rather difficult to plan runway and apron extensions without disclosing the size or the new plane. If I remember correctly the plane was the *then* sensational B-29.

Henry Rich added a humorous note to the above. "It proved difficult to keep men on the job because of the 'opportunities' found in Nevada. We had to use 'persuasion' to get saloon keepers to be cooperative."

District Cir. No. 225
WAR DEPARTMENT
U.S. Engineer Office
P.O. Box 1739, Wright Bldg.,
1209 - 8th St.
Sacramento (8), California

11 November 1943

DISTRICT CIRCULAR

Subject: Accomplishment at the Tonopah Bombing and Gunnery Range.

To: All Officers and Employees, Sacramento Engineer District.

1. The manner in which the expedited construction program was completed at the Tonopah Bombing and Gunnery Range has caused the Commanding General of the 4th Air Force to make written acknowledgement to this office, which is quoted in part for the information of all concerned:

> The fine spirit of cooperation displayed in the successful accomplishment of certain special and specific items of urgent construction at Tonopah Bombing and Gunnery Range is indeed worthy of special mention. The excellent organization of engineering and construction forces under your immediate jurisdiction has immeasurably contributed to the war effort. I desire to extend my sincere appreciation and commendation.

2. I desire to add my commendation to that of General Lynd for the whole-hearted effort that employees of the District put forth in completing this "impossible" job far ahead of schedule.

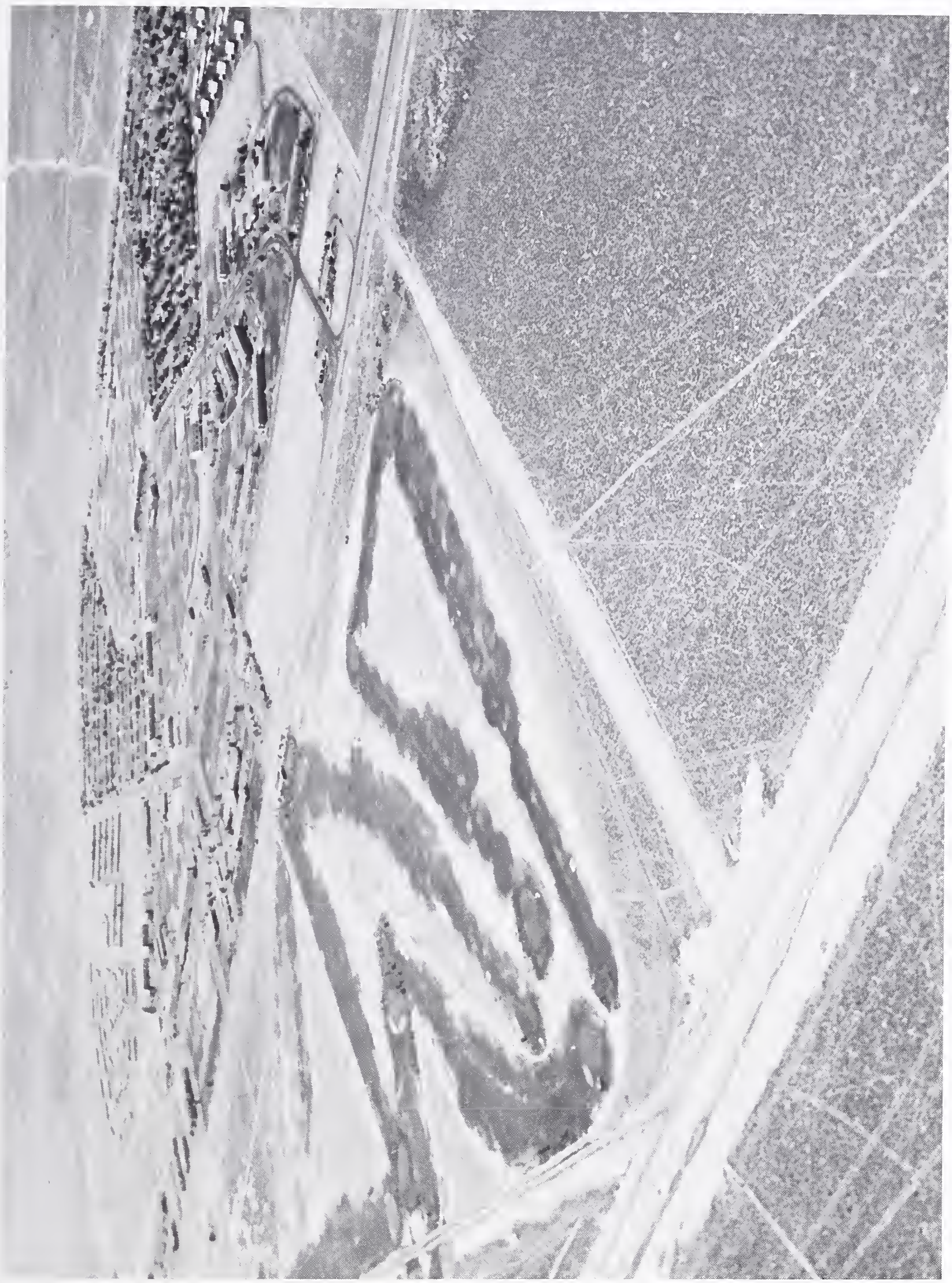
3. Approximately $8,000,000 of construction was completed in a period of a few weeks' time. This involved construction of fourteen miles of eight-inch water line, which was hauled from Sacramento, welded and buried in eight days. The amount of concrete in the warm-up apron alone equals a twenty-foot wide highway seventy miles long, all laid in three weeks. This does not include the asphalt pavement of runways, nor does it mention the structures or utilities completed in record time. The water supply for the project is no longer extremely scarce and critical, but is now abundant.

4. Commendation is not only due those employees who were engaged directly on the project and to those who successfully solved the transportation and material and equipment supply problems, but to all members of the District organization.

5. The Ephrata job was a good test of the team work of which the Sacramento District was capable. The Tonopah job was a further and more exacting test of the District employees' and our contractors' capabilities. These tests have been met to the entire satisfaction of all concerned.

DISTRIBUTION:
All Officers
& Employees.

R.C. Hunter
Colonel, Corps of Engineers
District Engineer



DUGWAY PROVING GROUND — UTAH (Ca 1948)
Army Corps of Engineers

By the end of 1943, new construction work was diminishing and the personnel strength of the District leveled off at about 1,200. Yet extensive modifications were still necessary to airfields and other installations to adapt them to new uses. Several airfields were enlarged and runways improved and extended to accommodate the vastly heavier aircraft that were being developed. Fairfield-Suisun, Merced (Castle Field) and Mather Field were among those whose pavements were strengthened to handle B-29 and B-36 bombers.

During this transition period it became necessary for the Corps of Engineers as a whole to contract their widespread activities by absorption and amalgamation of field activities to effect economies in administrative costs. As a part of this overall reorganization the Salt Lake City District of the Mountain Division, by General Order No. 19, Office, Chief of Engineers, of 18 September 1943, was abolished effective October 1, 1943.

> The responsibilities, functions, personnel, funds, property and records of the Salt Lake City Engineer District are transferred to the Sacramento, California, Engineer District, Sacramento, California. The territorial area of the Sacramento, California, Engineer District, is enlarged to include that of the existing Salt Lake City Engineer District.

As a result, the personnel strength of the former Salt Lake District was cut from approximately 900 to 150 employees and operations in the area continued as a field office of the Sacramento District.

From 1943 to the end of hostilities, the District, with its usual dispatch was busy completing Army and Air Corps facilities in Nevada and Utah. During 1943 the District began construction at Ogden Arsenal and Tooele Ordnance Depot worth almost eleven million dollars. That same year work was begun at Dugway Proving Ground valued at $1,700,000, and at Fort Douglas near Salt Lake City, $250,000. The hospital at Bushnell, Utah, was also begun in 1943 by Sacramento personnel. During 1944 work was completed at Deseret Depot, Salt Lake City Army Air Base and Wendover Bombing Range. In the spring of 1945 prisoner of war camps were built at Dugway and Utah Air Corps Station.

It is especially interesting to note that Sacramento-built facilities launched the first and the last aerial attacks on Japan. Doolittle's raiders, it will be remembered, left McClellan early in 1942 for the first bombing attack over Japanese cities. Colonel Tibbets and the crew of the "Enola Gay" were among the last. Both used Sacramento-constructed facilities.

On August 30, 1943, District personnel began work at Wendover Bombing Range in Utah, and by January 1, 1944, had completed the training facilities that had been authorized. As soon as this job was completed they began constructing proving facilities at Granite Peak. On December 17, 1944, the 509th Composite Group arrived at Wendover with their B-29s and began training. The unit was the first of the Army Air Corps to be equipped and trained for atomic warfare. Later in the year Colonel Paul W. Tibbets, Jr., and Major Charles W. Sweeney piloted two of the Group's B-29s over Hiroshima and Nagasaki, dropping the first and last atomic weapons used in war.

Upon cessation of hostilities many army and air corps installations became surplus to the needs of the country and were disposed of either directly by sale or transferred to the War Assets Administration for ultimate disposal. This was also the case with the mass of equipment and supplies that had accumulated. Many of the larger bases within the District after V-J (Victory in Japan) day, particularly Mather and McClellan, served as debarkation points for returning aircraft and personnel. In 1947, the Sacramento District's military functions were discontinued, with one important exception, the underground explosion tests conducted in Utah.

CHAPTER VI
PREPARING FOR CRISIS

Allied victory quickly turned sour. Within a few months, the Soviet Union ignored her wartime pledges and with a barbaric appetite gobbled up most of Eastern Europe. Soon antagonism between the free and communist nations became a fundamental condition of the postwar world that affected almost all aspects of public life, foreign and domestic. Even before the end of the war, relations were deteriorating between the Soviets on the one hand, and the United States and Great Britain on the other. The situation worsened during 1946 over Germany, the Middle East and atomic energy. All the while the Russians secretly continued to work on their version of an atomic bomb.

In 1947, with a new arms race under way, the Sacramento District became involved in gathering data for military planners. Washington wanted information on "protective construction" and the transitory effects of large scale (nuclear) explosions upon military installations. The Sacramento District conducted a nation-wide search for suitable areas in which to conduct such tests (soil types, rock formations, etc.), and to locate an engineering firm capable of building the necessary facilities. Favorable soil and rock formations were found to exist in Utah and Colorado. The prime research and development firm awarded the contract for the work was the Engineering Research Associates of Arlington, Virginia. It was their task to determine how effectively and economically to construct facilities that would withstand high yield forces.

Jim Coombs stated that, "I consider it (Underground Explosion Test Program) to be the most significant during my tenure with the government . . ." In addition to the prime contractor, several other firms and agencies worked under Corps supervision in the construction and instrumentation of the program. Some of those responsible for the work were:

U.S. Bureau of Mines
U.S. Coast and Geodetic Survey
Morrison-Knudsen
Colorado School of Mines
Denver University
Armons Research Foundation
Rensselaer Polytechnical Institute
Stanford Research Institute
U.S. Armed Forces Special Weapons Project
U.S. Geological Survey
U.S. Ordnance Department

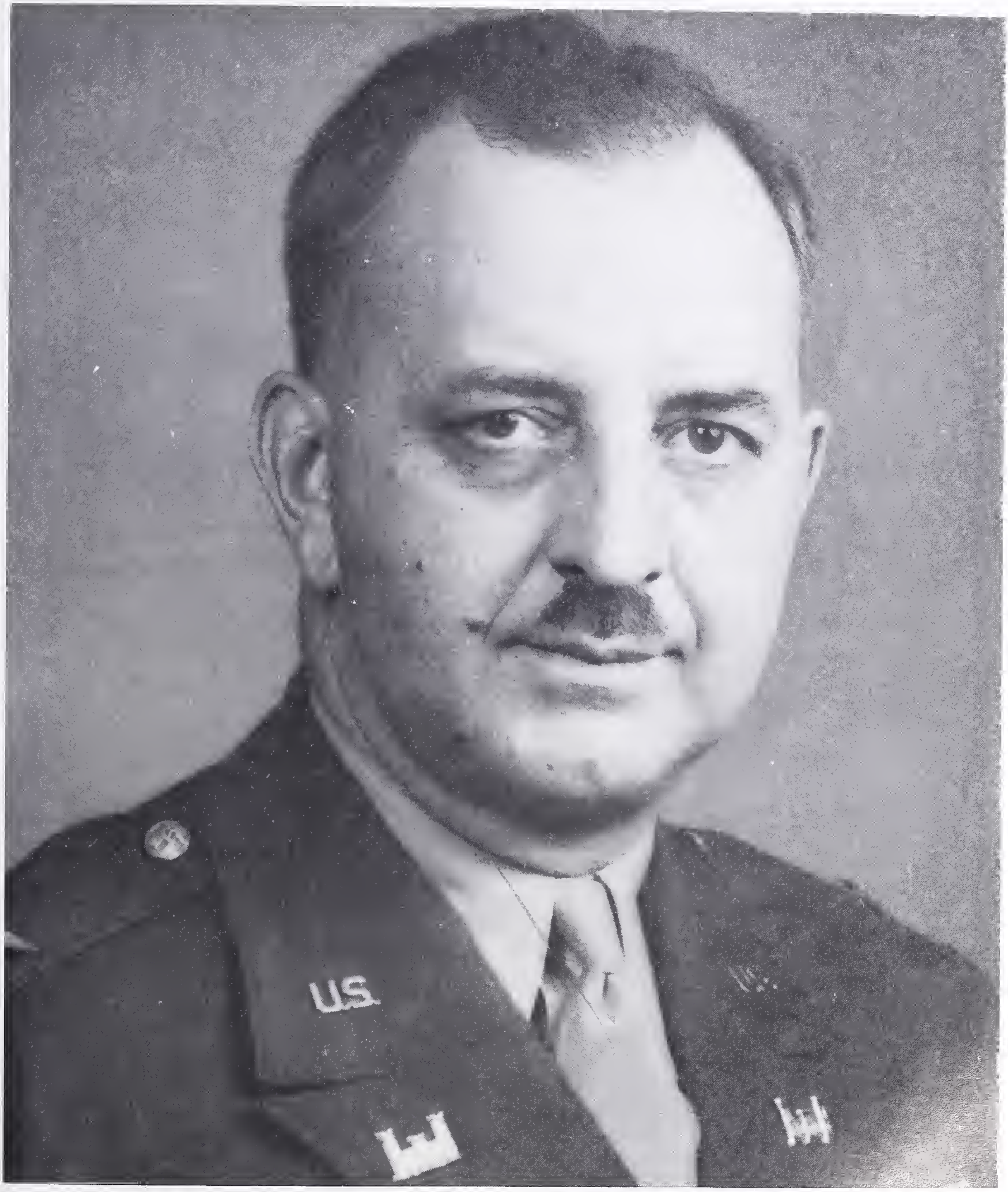
Mr. Coombs gives some further details about the project.

> District personnel accomplished much of the work, such as: (a) Geology of all sites, (b) Soils sampling and soils analysis, (c) Site surveys, (d) Site reports and site selection. Many of the outstanding scientists of the country were also involved as special consultants for the program. The Sacramento District was responsible for the conduct of the program with technical assistance from OCE. Sacramento District personnel responsible for supervision of the project were Henderson McGee, Walter Grimes (early in program), F.W. McGregor, and myself.
>
> The reason I feel that the project had significance was in the manner in which the tests were conducted and the problems that had to be solved. Since there was very little data available on underground explosion effects, the program was developed on a 'crawl before your walk' concept. The effects of very small charges of TNT were determined before larger charges were detonated, until a detonation of 320,000 pounds of TNT was made in soil and rock. These tests were extrapolated to the 20 kilo ton TNT equivalent to record what explosion effects were available and had to be developed, including cable, dust collection, photography and various gage types for soil, rock and structures. As previously mentioned the test results were used to set up the atomic testing in Nevada, and, I suspect, the more recent deep underground charges in rock. It is therefore apparent that every effort had to be made to obtain the best test data possible. This was a great challenge to all participants as well as the Corps of Engineers.

COLONEL LESTER F. RHODES
SACRAMENTO DISTRICT ENGINEER - JUNE 1945 - AUGUST 1947
(Army Corps of Engineers Photo)

UNDERGROUND EXPLOSION TESTS
(Army Corps of Engineers Photos)

UNDERGROUND EXPLOSION TESTS



COLONEL JOSEPH S. GORLINSKI
SACRAMENTO DISTRICT ENGINEER - SEPTEMBER 1947 - MARCH 1950
(Army Corps of Engineers Photo)

RECIPIENTS OF 20-30 YEAR EMBLEMS - 1949
(Army Corps of Engineers Photo)

RECIPIENTS OF 20-30 YEAR SERVICE EMBLEMS, SACRAMENTO DISTRICT, CORPS OF ENGINEERS, ENGINEER DAY, 16 JUNE 1949

Front Row: Domingo T. Macaraig (32 years), Irving R. Foster (31 years), Elmo A. Brule (38 years), Elsie Mann (31 years), Horace Mann (35 years), Rowland L. Egenhoff (36 years), August E. Raezler (35 years), Col. Joseph S. Gorlinski, District Engineer, Henry M. Rich (39 years), Ralph G. Griffin (39 years), Maland M. Stooks (36 years), James B. Fraser (31 years),
Second Row: Robert B. Douglass (20 years), Frank A. Darby (22 years), Henderson E. McGee (22 years), William G. Sherman (26 years), Francis G. Christian (20 years), William R. Daniels (20 years), George J. Mollison (25 years), Carl A. Behrens (26 years), Bert R. Carnahan (24 years),
Third Row: William E. Lint (22 years), Walter V. Donnelly (23 years), Harlan D. Ellmaker (25 years), George F. Ricci (23 years), Lynn A. Bedwell (20 years), Milton Farley (22 years), Curtis Greene (21 years), James F. Choate (23 years), Paul Bennett (21 years),
Fourth Row: Harold Tofsrud (21 years), Edward V. Metcalf (27 years), Kenneth C. Elmes (23 years), George T. Wilson (21 years), James H. Kroh, Jr. (21 years), Orville H. Hart (21 years), Manuel F. Nascimento (21 years), Arne Solvig (24 years), Olaf O. Olsen (23 years),
Fifth Row: Edward W. Blackmer (27 years), James A. Pennell (22 years), Erwin G. Dahneke (21 years), Ralph B. Brown (21 years), Julius Nelson (31 years).
In addition to those pictured, the following employees who were unable to attend the presentation were awarded service emblems: Richard F. Monson (38 years), Stanley Leslie, retired (35 years), John W. McCormick (33 years), Katherine A. Maxwell, retired (31 years), Michael J. Donovan (28 years), William Beinhauer (27 years), Percy L. Jones (23 years), Joyal R. Morton (23 years), Walter J. Daveler, retired (23 years), Victoriano A. Llopis (21 years), Willis C. Spaulding (21 years), Robert R. Morley (21 years), Arthur C. Showman (21 years), Thomas B. Morris (21 years), Donald G. McConnachie, retired (21 years), Ernest A. Sugg (20 years), William B. Gerhart (20 years).

Prior to official reports being issued about the project in the spring of 1948, rumors circulated that underground factories and other facilities were to be built. Some even believed that the Army was drilling for oil. H.O. Plath, Resident Engineer at Salt Lake City, spiked the speculation when he explained, "The only things we are putting underground are explosives and the targets." On March 15, 1948, Colonel Joseph Gorlinski, District Engineer, and Henderson McGee conducted a group of twenty-five military and civilian experts, many from the Sacramento District, on a tour of the sites and later met in Salt Lake City for consultations. Site selection began in 1947, followed by actual construction work in the spring of 1948. By the summer of 1952, the scene was set for the most violent non-atomic explosion set off to that time.

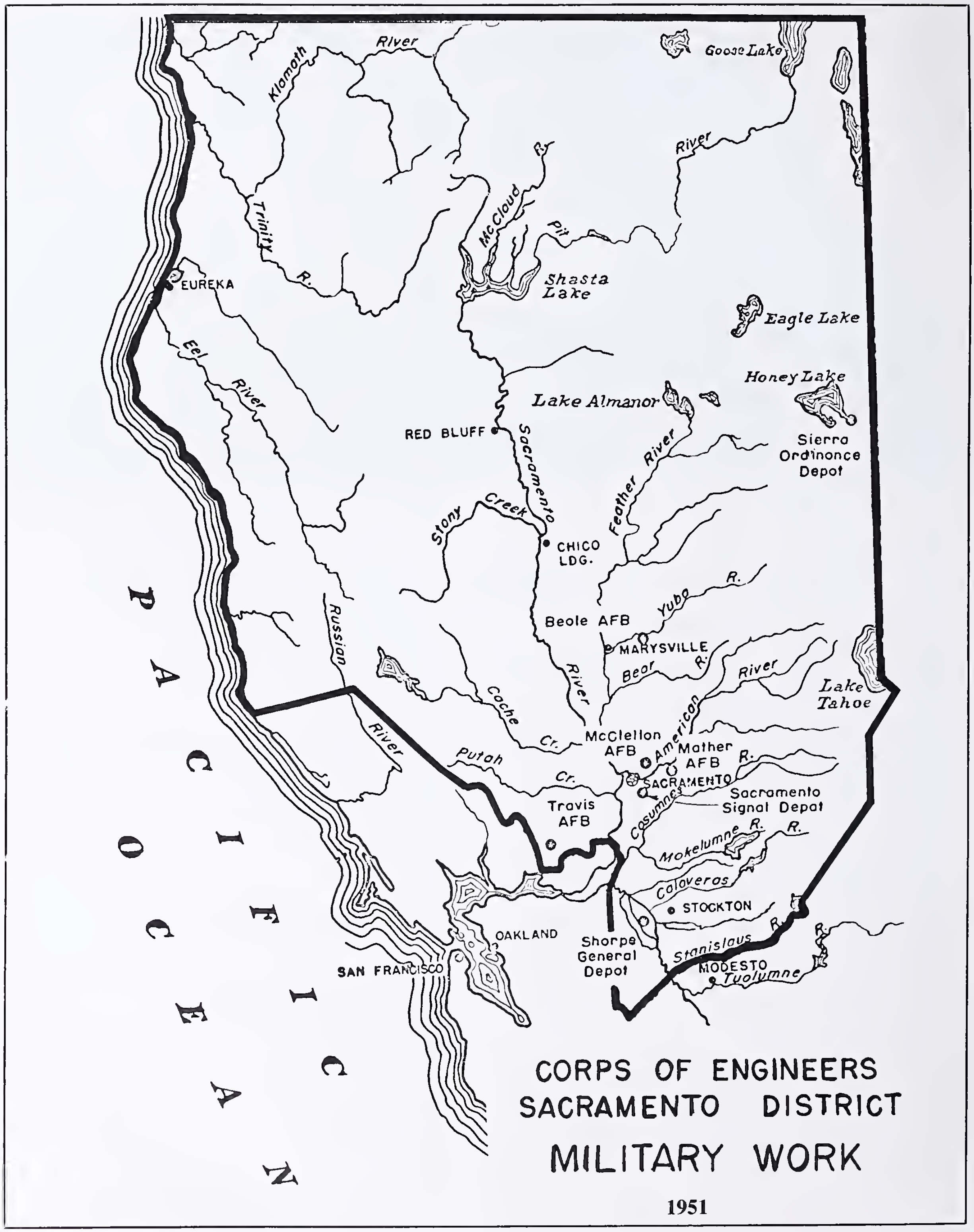
On July 8, 1952, Sacramento District engineers accompanied by physicists, detonated four rail carloads — 160 tons — of TNT at Buckhorn Wash, near Castle Dale, Utah. Construction crews had worked for four years digging tunnels and building protective structures at the blast site. Even though the charge contained the same amount of high explosives used in the blast in dry clay near Dugway Proving Grounds a year earlier, which was then the most powerful non-atomic explosion ever detonated, the Buckhorn blast, because it was imbedded in a cliff of Navajo Sandstone, exceeded the Dugway explosion in intensity.

The entire test site was honeycombed with instruments to record the behavior of the shock waves and the strain on the rock being tested. Arrangements were made to record the shock of the spectacular blast as far away as Pittsburgh, Pennsylvania, in the laboratories of the Carnegie Institute of Technology. Instrumentation development, in fact, had been one of the factors that accounted for the great length of time involved in setting up the tests. Moreover, each target was built to scale. In all, three sites comprised the intermountain underground testing program. Within the Dugway area, tests were conducted in sand, clay and limestone. At Castle Dale, Utah, sandstone was utilized, and at Grand Junction, Colorado, test work was completed in granite. By the time of the Buckhorn blast in 1952, more than seventy explosions had been set off. Testing done under this program finally came to an end in 1954.

Another kind of underground construction, the backyard bomb shelter, also made its debut in the early 1950s. Americans had become increasingly jittery ever since the end of the war as they realized that communism was out to conquer the free world. A formidable deterrent to unrestrained expansion of communism was America's monopoly on atomic weapons. This security was shattered and the public stunned when President Truman announced on September 23, 1949, that the Soviet Union had exploded an atomic bomb some three weeks earlier. Washington was just as shocked and unnerved as the man on the street, because its policy of "containment" had made no allowances for such a contingency. In the end, Washington's answer was to build hydrogen bombs.

The following summer, the nation's fear of communist aggression was vindicated. After months of minor skirmishes with their brothers to the south, the North Koreans launched a massive invasion across the thirty-eighth parallel at 4:00 A.M., Sunday, June 25, 1950 (Korean time). Whether it was the Russians, the Chinese or the North Koreans who made the decision for invasion and why, at this particular time, has never become known in the West. Many believe that the chain of events followed from Dean Acheson's "defense perimeter" speech of January, 1950. His line ran through the Aleutians, Japan, the Ryukyus and the Philippines. Formosa and Korea were outside of what he believed to be our defense responsibility. Those not within the perimeter, if attacked, would have to rely upon their own power to resist "and then upon the commitments of the entire civilized world." Regardless of who made the decision or for whatever reason, the North Koreans invaded the South, and once again American "blood and treasure" were spent in its defense.

The Sacramento District became involved, though indirectly, when military design and construction responsibilities were again as-



CORPS OF ENGINEERS
SACRAMENTO DISTRICT
MILITARY WORK

1951

COLONEL C.C. HAUG
SACRAMENTO DISTRICT ENGINEER - APRIL 1950 - JUNE 1953
C.E. Photo

signed on January 1, 1951. The new boundaries for military work comprised all the counties in northern California north of and including Sonoma, Napa, Solano, Sacramento, San Joaquin, Calaveras and Alpine with the exception of Benicia Arsenal which remained within the boundary of the San Francisco District.

The effect of the war (police action) on Army and Air Force installations within the District was immediate. Jolted out of their comparative serenity, military and civilian personnel rebounded from their shock and hustled to supply General MacArthur, an engineer officer himself, one more time. In the three years and thirty-two days of the Korean conflict, the United States sent more than one and a half million soldiers, sailors and airmen to fight with the United Nations forces against the communists, both Korean and Chinese. From Travis, Mather, McClellan; from Sierra Ordnance Depot, Sharp Army Depot, from Lathrop and Tracy; from runways and warehouses built, rebuilt, expanded and extended by men and women of the Sacramento District, men by the thousands and supplies by the thousands of tons enabled allied forces to hang on and finally push back the enemy. But even the genius of MacArthur couldn't achieve a clear victory in Korea. The conflict ended in an armistice and long-drawn-out negotiations.

The military boundaries of the District were again expanded on October 1, 1955, to include the State of Nevada, except the southern counties of Lincoln and Clark. Four years later, in an attempt to equalize the workload between the Sacramento and San Francisco Districts, specific military projects such as Sharpe General Depot and Travis Air Force Base were transferred to San Francisco from Sacramento. The geographical areas transferred included Del Norte, Trinity, Humboldt, Mendocino, San Joaquin, Siskiyou and Sonoma counties.

With the expanded boundaries came an increased work load. The Strategic Air Command's massive buildup during the 1950s also had a direct effect upon type and number of projects undertaken by the District. Their new super heavy bombers, the B-47 and later the B-52, had the same kinds of effects on runways during the '50s as the B-17 and B-29 did on flight strips designed for their predecessors. For example, in 1958 when Strategic Air Command's 320th Bombardment Wing was assigned to Mather, more than $20,000,000 was spent on the construction of additional runways and buildings to handle the heavy bombers and refueling tankers. Similar conditions existed at the other large air bases located throughout the District. Several of the older pavements (constructed in 1942-43) that had been heavily trafficked and on which distressed slabs had not been replaced, were found to be in a poor condition. In several of the airfield pavement evaluation reports written in the late 1950s, one finds the following kinds of remarks:

> The most probable cause of damage to the pavements is overstressing due to the operation of aircraft considerably heavier than that for which they were designed . . . The slabs which are under the landing wheels of the B-52s and KC-135s have shown signs of movement along the cracks and some slight fragmentation has been noted.

Not only strength but length was a factor in the new facilities constructed in the late fifties. The improvement at McClellan is a case in point. In January 1958, the Sacramento District completed a 3,450-foot extension to the base's main north-south runway. The new total length, not counting a new 1,000-foot overrun at the north end and 970 feet converted to overrun at the south end, came to 10,530 feet. Some of the newer runways were so wide that many smaller aircraft could actually land cross-wise. Long-needed modernization and expansion of storage facilities and personnel housing were also started during this period.

Dental clinics, community centers, service clubs, schools, exchange sales stores, dormitories, commissaries, officers' quarters, steam plants, recreational and training buildings, medical facilities; in fact, just about any and all things necessary or desirable for a people entering the space age were being constructed by the Sacramento District during the late 1950s.

COLONEL W.L. ELY
SACRAMENTO DISTRICT ENGINEER - JULY 1953 - DECEMBER 1955
(Army Corps of Engineers Photos)

In 1957, the District was given the unique opportunity to design a complete, modern air base from the ground up. Ten years earlier, old Camp Beale near Marysville, had been declared surplus by the War Department. On September 29, 1947, the War Assets Administration assumed custody of the base and reserved certain portions for the National Guard. Early in 1948 the Air Force requested the W.A.A. for Beale and a transfer was arranged. For the next three years, until 1951, the old army cantonment saw limited use as a bombardier-navigator training facility. Six years later it was designated a SAC base. In the spring of 1957, the Sacramento District engineers broke ground for the installation's first modern runway. By the next summer the District had completed a 12,000-foot airstrip with 500-foot overruns on both ends.

Named for Edward Fitzgerald Beale, founder of the U.S. Army Camel Corps and Commissioner of Indian Affairs in California and Nevada, the base is one of the few in the nation designed from the start as a contemporary and highly sophisticated Air Force facility and not a made-over airdrome constructed to service craft of an earlier era. Runways were laid out in logical areas and didn't have to be put down just to avoid a barracks, or in an area where soil conditions happened to be suitable. Support facilities and community services, for a change, were constructed with an eye to aesthetics, and to blend with and complement the total program of a modern city. For, over the years, that's what Beale, thanks to sound engineering and design practices, has become, one of the largest communities in the area. The Sacramento District, and Beale in particular, received some of their most exciting news, and one of the District's most valuable contracts, during 1959, with the word that the District had been selected to construct a Titan Ballistic Missile site near Beale Air Force Base.

Involvement in missile support systems was nothing new, however, for the Corps of Engineers. Ever since the Armed Forces initiated their missile research and development programs in 1945, Army Engineers had played a supporting role with their vital construction efforts. And when the first Nike battery became operational in December 1953, the Corps of Engineers could be justly proud of its contributions to its development. This first antiaircraft missile program was the outgrowth of the realization that a single plane carrying a nuclear weapon, and penetrating the defenses of a community, spelled total destruction and annihilation of the city and its families. Soon Nike missile installations were deployed throughout the United States in defense of its major industries and cities.

As additional information about Soviet aircraft became available, defense officials feared attacks by huge formations of supersonic enemy bombers that could deliver their terrible engines of death from extremely high altitudes. The Nike Ajax, as the first missiles were called, was capable of destroying a single enemy bomber some thirty miles distant. Before long this original system was modified and armed with a nuclear warhead and renamed Nike Hercules. Now a single missile could smash whole fleets of enemy aircraft a hundred miles from launch site. Transformation of the Ajax missiles into the faster, more powerful and deadlier Hercules was begun in California in May 1958.

As missile preparedness was accelerated, construction of the more conventional defense system diminished proportionately. A case in point: In fiscal year 1957, 37 percent of the Army's total military construction program was in support of various missile projects. But by the very next year this percentage had climbed to 48 percent. The advance in missile construction for the Air Force was even more dramatic. Allocations there jumped from 2 percent of the total budget in 1957 to approximately 50 percent by 1960.

While the Nike Hercules could blunt any enemy bomber raid, it couldn't be counted on to stop a missile barrage. Intercontinental ballistic missiles race toward their victims at 20,000 miles per hour. Thus when plans were being formulated in 1956 to devise a defense against them, the difficulties seemed insurmountable. Once again the Nike system was updated and greatly sophisticated. The result was the con-

troversial Nike Zeus. Some top-ranking Army officers suggested that with further modification the latest Nike could even be made to intercept and destroy Russian satellites.

More sophisticated missile systems required improved and expanded radar facilities, both to track the incoming enemy and to guide the deterrent. Jack English described a humorous and potentially lethal incident that he shared while in search of such a radar site.

> The period just after the Korean War and on through the fifties saw considerable activity in the construction of radar and communications installations. Inasmuch as these generally required mountain top locations, considerable exploration for suitable sites was required. I personally visited many peaks in California on these projects, and can recall many rough but interesting trips. Probably the most exciting of these was one to the top of Fredonyer Peak, Elev. 7,995 feet, Lassen County, California. It was a rugged peak with jagged lava formations at its summit. In order to ascertain the adequacy of the area required for a possible installation, it was necessary for my partner in this venture (a liaison engineer from San Francisco District) and myself to determine measurements by pacing. Considering the rugged terrain this was no easy task, especially so when we encountered a very steep escarpment directly in our path. As we were pondering how to overcome this problem, an immediate solution presented itself, for there above our heads on a small ledge appeared a magnificent mountain lion in all its fury, teeth bared, tail lashing, at the same time emitting that spine chilling warning peculiar to that species. We froze, each of us carefully picked up a rock and *very carefully* backed away, then slowly retreated to the safety of the Forest Service Lookout.
>
> Needless to say we never completed that measurement on the ground. It was the only survey in which I participated where a vital distance was estimated by eye alone!

With the Underground Explosion Tests as a base, new data were collected and integrated by the Sacramento District to formulate a rather complete bank of knowledge related to missile support systems. By the mid-fifties District personnel had already determined that, "Criteria for the underground storage of materials for survival and retaliation include an areal limitation between latitudes 35 degrees and 40 degrees, west of the crest of the Sierra Nevada, excluding an area of 40-mile radius from San Francisco . . ." And since the Corps, in general, and the Sacramento District specifically, had been supporting the Armed Forces missile program with construction from their earliest research, construction of Titan sites by the District was but a natural extension of this work on behalf of the Air Force's retaliatory capability. It should be remembered that construction of ground support facilities for missiles is complex in the extreme. Facilities have to be prepared from which to launch, house, and track the "big birds." Additionally, other technical equipment and facilities to house personnel are a necessary part of the job. Finally, Corps construction had to be integrated with the schedules for missile fabrication and its related equipment, and with the training of personnel.

Flexibility seemed to be the key to success. While the Corps was completing its part of the project, for instance, the Air Force was proceeding with research and development on the yet unproven Titan itself. To further complicate the situation, each change in the missile required modification of the underground silos, equipment terminals, control centers and/or powerhouses.

On January 30, 1959, the Air Force announced that studies were about to get underway to survey possible missile site locations in the vicinity of the Strategic Air Command's Beale Air Force Base. Surveys were conducted by Sacramento District teams throughout the summer. On September 17th, Colonel Paul Carlton, Commander of the 4126th Strategic Wing at Beale, announced that the base had been selected as the fifth Titan Intercontinental Ballistic Missile site. Beale AFB was desig-

COLONEL ALBERT E. MCCOLLAM
SACRAMENTO DISTRICT ENGINEER - JULY 1956 - JULY 1959

nated as the support base for the underground silos located within a fifty-four mile radius. One site was about eight miles north of Chico, another was approximately ten miles west of Live Oak in the Sutter Buttes area, and the third was located only a few miles southeast of Lincoln. Originally, it was estimated that twenty-two months and forty-two million dollars were required to accomplish the construction task.

Within a few days of the announcement, Sacramento District personnel began negotiating directly with the landowners involved to acquire the real estate, about sixty acres each, for the sites. A measure of the significance of the project was the declaration of Harold Robinson, director of the California Disaster Office, that California might have to alter its plan to utilize Chico as the provisional state capital in the event of a disaster.

By September 24, 1959, a field office of the Air Force Ballistic Missile Division, Air Research and Development Command, was opened at McClellan Air Force Base to supervise the installation of equipment for the three Titan launching sites. Following this action, the Sacramento District, by District Order No. 59-51, established the Valley Area Office on 30 September, in the old Splinter City area of McClellan, with Olaf Lein in charge. Earlier, Mr. Lein had served as Assistant Chief of Construction-Operations Division. Colonel Howard Morris, District Engineer, appointed Arden Kull and Ellsworth Kanzler to assist Lein. Prior to his new assignment, Kull had been honored by the Air Force for his efforts in postwar planning of air fields and supervising construction activities at Travis AFB. Kanzler had performed in a similar capacity at Mather, McClellan and Beale.

Colonel Morris assigned Fred Fader resident engineer responsibilities at the Lincoln site, G.W. (Bud) Probasco at Sutter Buttes, and Joe Nelson to serve as resident engineer at Chico. Bids for the Titan work amounting to approximately $30,000,000 were opened on January 12, 1960, in the Empire Room of Sacramento's Hotel Senator. More than 600 excited and anxious contractors and spectators jammed the room to learn that Peter Kiewit Sons' Company of Arcadia, Los Angeles County, had submitted the low bid. Some bidders came from as far away as Iowa in hopes of getting a "piece of the action."

When work began in January 1960, negotiations were relatively uncomplicated for the civil type work, such as excavation, backfill and concrete operations. But as the project progressed into the spring and summer, changes assumed a more complex and demanding nature. Hence, negotiations became more difficult. Modifications, due to new data and changes in the Titan missile, compounded each other, while removal of completed work added to the complexity. The unique nature of the construction, such as purging of pipes, welding stainless steel pipe and new cleanliness requirements meant that new procedures had to be employed. Some idea of the magnitude of the task may be gained by comparing the initial contract of $30,000,000 with the addition of about 400 changes with a dollar value of approximately ten million.

Excavation of the shafts for the missile silos began on March 10, 1960, and were generally complete by late summer. Backfilling began in September and was finished within a few weeks.

More than 600,000 cubic yards of rock and earth were excavated, stockpiled and then rehandled for the backfilling during the construction of this complex. When completed, approximately 32,000 cubic yards of concrete, 90 miles of cables, 300 tons of piping and about 1,800 separate Air Force supply items could be found at any one of the three sites.

Each site included three missile silos with related propellant and equipment terminals, a control center, a power house, two antenna silos, entry portal and a complex system of tunnels which connected the various components. All were underground! The silos themselves were 155 feet in depth with an inside diameter of 40 feet. The concrete walls of each silo were up to three feet thick and the top of each was covered by a pair of horizontal leaf concrete doors weighing 125 tons each. Using information gathered during the Underground

Explosion Tests of earlier years, the structures and equipment contained therein were protected from the shock of possible atomic blasts by incorporating protective construction features into each project.

Just as the project passed the mid-point of completion, the Sacramento District's role in the work was terminated, with supervision of the construction being transferred to the recently created Corps of Engineers Ballistic Missile Construction Office (CEBMCO) in Los Angeles. The office had been established to strengthen, steamline, expedite and integrate all Intercontinental Ballistic Missile (ICBM) construction efforts nationwide. At the time, ICBM construction consisted of Titan, Atlas and Minuteman squadron sites at or near selected bases all over the country, in addition to testing facilities at Vandenberg AFB, California and Cape Canaveral (Kennedy), Florida. CEBMCO was opened in Los Angeles on 1 August 1960, but Sacramento's Titan work wasn't transferred until 1 November 1960. At the time the change took place, Colonel H.N. Turner, District Engineer, stated, "It is very satisfying to turn over the project to the new office knowing construction is ahead of schedule." Lieutenant Colonel Joseph Sherrard headed up the new Beale Area Office, as the office was now called, with Olaf Lein acting as Deputy Area Engineer.

At the time of transfer to CEBMCO, 95 District employees were assigned to the work in the field and a substantial part of the production time of the Construction Branch was involved with the work. Moreover, at the time of takeover, wherever practicable, personnel already performing various duties were transferred to the new Area Office.

Once the missile sites were nearly operational (they never had to be used, thank God!), they suffered from severe accidents and before long were declared obsolete and abandoned. On May 24, 1962, a terrific blast at the Chico site destroyed a Titan missile and heavily damaged the silo in which it was housed. In the investigation that followed, the Air Force stated that two separate explosions had occurred because of a blocked vent and a blocked valve. Two weeks later, on the sixth of June, a flash fire broke out in another silo, killing a worker. Besides taking a life, the accidents caused damage in excess of ten million dollars. Finally, in March, 1965, the Titan I missile squadron was deactivated.

Before we leave our discussion of the fifties, another military construction project is worthy of noting. On May 15, 1956, the new Automatic Teletypewriter Switching Center at the Davis Transmitter Station, a key installation in the Army's strategic communications system, was dedicated in ceremonies that included Major General Cordeman, Deputy Chief Signal Officer, and Governor Knight of California. The first of its kind to be placed in service, the complex consisted of three vital units, a Transmitter Station near Davis, a Receiver Station on a mesa just east of Middleton, Lake County, and a Relay Tower located on the summit of Mt. Vaca near Vacaville.

Once again Mr. Jack English is called upon to add a personal touch to this interesting construction job.

> The siting of the component parts of this facility posed many interesting problems for at that time direct line of sight was required between each unit, thence from the Relay Tower to the Presidio. Considerable exploration and travel was entailed in locating and checking the feasibility of the sites finally selected. The Mt. Vaca site was unique inasmuch as it was in the ideal position to fulfill the requirements of the system, and fortunately there was just sufficient area adequately to contain this facility. However, this location *was* subject to very high winds, and inasmuch as the function of the tower required a structure practically vibration free, this structure was very rigidly designed using very solid materials; the steel structure was very heavy.
>
> Access to the tower site was by a very narrow and winding trail, so delivery of construction materials was somewhat difficult. I suppose that if this tower was being constructed today the steel members would be easily delivered by helicop-

TRANSMITTER STATION NEAR DAVIS, CALIFORNIA
(Photo courtesy Jack English)

ter. I remember that during construction I was at the tower one afternoon when the wind was coming in from the coast, and it was the only time on a construction job that I ever saw steel workers crawling along the beams, like old time seamen working sail aloft in a gale . . . *they also quit work in mid-afternoon,* . . . the wind velocity was too much for them, somewhere around 80 miles an hour. Incidentally, during the preliminary site studies, I remember that the engineer from Sixth Army Signal Corps and myself were determining the practicability of a certain line of sight . . . and the signal we were attempting to pick up was from an old army heliograph . . . that was certainly a marriage of the *ancient* and *modern.*

Alas, all the effort that went into the design and construction of this fine system was lost to much more sophisticated facilities now available . . . the communications satellites now do its work. Strange as it may sound . . . the Transmitter Station near Davis has been "given back to the Indians" for a college. I feel rather good about this action for the buildings were well designed and constructed and should prove very useful for this purpose. Incidentally this Station occupied one complete section of land (i.e. six hundred and forty acres more or less, so there is adequate area for any future expansion of the campus.)

The fully automatic teletype switching center, which was placed in service in May of 1956, was the first full-scale installation of its kind in the world. It was the center for official Army teletype messages west of the Mississippi River, and served as the jumping-off point for Pacific overseas radio messages to Honolulu, Tokyo and the Far East. The station was the farthest step yet taken to perfect worldwide communication. The earliest transmitting station in the Sixth Army area (then known as the Ninth Corps area) was located at the Presidio of San Francisco and sent its messages via old "Marconi type" antennae supported between two towers. By 1930 this had been replaced with commercial sets delivering up to 10,000 watts. Some improvements were made prior to the War, but, "During an emergency, the tape waiting for transmission or typing would frequently pile up until it covered the floor." Further modifications were made, but even so, the extra heavy load placed upon the system during World War II emphasized the need for further development in automation. After a great deal of study, experimentation and terrain surveys (some twenty sites in all) the site between Davis and Winters was chosen. While it served, especially in those fearful years following Korea, the Station contributed substantially to the defense of our country.

The Sacramento District embarked upon the decade of the sixties with prospects of the largest dollar workload since it had built Folsom Dam. In no small way, the huge Titan project, coupled with the civil mission, accounted for the optimism. When all missile work was given to CEBMCO however, the District adjusted itself to a workload equaling only about half of that expected at the beginning of the fiscal year (July, 1960). This shift, while taking away one of the largest contracts in the District's history, was directly responsible for the transfer of practically all of San Francisco District's military design and construction activities to the Sacramento District. The greatly reduced military workload within Corps Districts nationwide, because of all missile projects going to CEBMCO, meant that the number of Districts performing a military mission was cut to only seventeen. In the shuffle, Sacramento also assumed responsibility for all real estate activities, both civil and military, of the San Francisco District. Moreover, by the same directive of 7 April 1961, OCE General Orders No. 9, all other services related to military design and engineering, military construction and real estate were transferred as well. By this change, effective 1 July 1961, Sacramento took over the design and construction of major facilities at the following military installations: Hill AFB, Dugway, Castle AFB, Travis AFB, Fairfield, El Cerrito, Eureka, Salt Lake City, San Jose, Santa Cruz, Santa Rosa,

A GROUP FROM THE ORGANIZATION KNOWN AS "WOMEN IN CONSTRUCTION" TOUR THE S-IV-B TEST COMPLEX. JOE NELSON, U.S. ARMY CORPS OF ENGINEERS AT THE NASA PROJECT OFFICE, IS EXPLAINING THE USE OF THE SAFETY NET TO THE HAPPY GROUP. (Ca 1964)

(Army Corps of Engineers Photo)

Two Rock, Wendover AFB, Madera, Modesto, Rio Vista, Sharpe General Depot, Golden Gate Cemetery, Little Rock Hospital (Little Rock District), Almaden Air Force Station (AFS), Ford Ord, Hamilton AFB, Mill Valley AFS, Point Arena, San Francisco Defense Area, Sunnyvale, Oakland Army Base, Benicia Arsenal, Forts Baker and Barry, Presidio of San Francisco, Klamath, Presidio of Monterey, Vallejo, Fort Mason, and San Francisco National Cemetery.

If this wasn't enough to boost sagging spirits, it was also learned that Sacramento was to play a vital role in President Kennedy's strategy to have an American on the moon by decade's end. In compliance with a joint agreement between the Corps of Engineers and NASA (the National Aeronautic and Space Agency), dated April, 1960, as amended December, 1961, the Sacramento District gained responsibility for the construction of two static test stands and related works for the Saturn S-IV-B rocket engine. On November 2, 1962, Colonel H. N. Turner, District Engineer, designated Joe Nelson as Project Engineer for the new missile support work. In the same district order Colonel Turner stated that as of 14 November 1962 a Project Office would be established and function as a unit of the Construction-Operations Division.

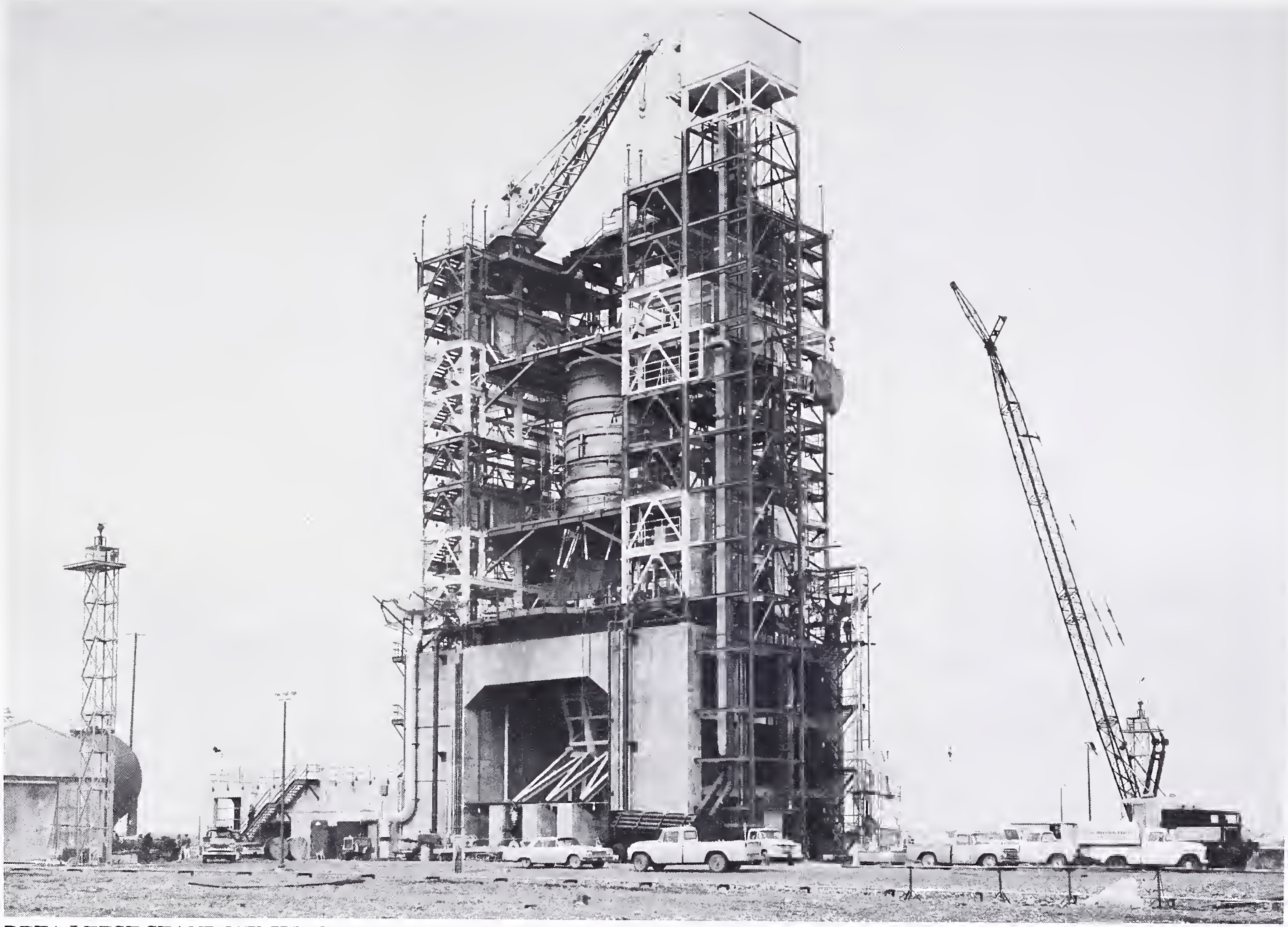
Early in 1962, the Los Angeles District began designing the complex while Sacramento began site preparation. In November 1962, Colonel Turner announced that bids would be asked in January 1963, for construction of the moon rocket testing facilities main contract.

The Saturn program had been in the planning for over six years by the time the test facilities were ready. Back in the spring of 1957 a group headed by Dr. Wernher von Braun began studies which eventually led to the Saturn, America's first vehicle developed specifically for deep space investigation. On August 15, 1958, the Advanced Research Projects Agency (ARPA) took the first steps in what finally developed into the Saturn project. A year later, November 18, 1959, NASA assumed technical direction of the program pending formal transfer from the ARPA. Only two months later the Saturn project was approved as a program of the highest national priority.

During the summer of 1961, construction of the liquid hydrogen test site neared completion at Sacramento Test Facility. To speed the project along, facilities existing from earlier programs were utilized. Then in December, prototype S-IV stage tankage was installed and propellant loading tests began. Progress continued on the second stage of the rocket, and on August 17, 1962, the initial static firing of the S-IV took place at Sacramento. During the test some 90,000 pounds of thrust was generated for ten seconds. On October 4, a firing lasting seven full minutes was successfully completed. By the middle of November a total of eleven tests had been completed on the test stands constructed under the supervision of the Sacramento District.

The S-IV-B stage left Huntington Beach for Sacramento in March of 1966, where it would undergo acceptance firing. Throughout the late sixties the test facilities served to prove and improve the S-IV-B engine. All was progressing quite smoothly at Sacramento until on January 20, 1967, the Saturn's third stage exploded shortly before its scheduled ignition. The terrific blast completely destroyed the engine about to be tested and also did substantial damage to the test stand. Later it was learned that the wrong welding material was used on one of the ambient temperature helium storage spheres located on the engine thrust structure. An unidentified witness described the explosion. "I was driving toward Folsom about five miles from the center when I saw a big ball of fire. Then I felt a shock wave." Before it was destroyed, the rocket motor was designated to propel astronauts Frank Borman, Michael Collins and William Anders into earth orbit for a full-scale rehearsal of moon flight operations.

Even though the massive rocket was reduced to flaming rubbish, and the entire Saturn program set back, no one was injured and eventually the United States put a man on the moon before the sixties were over. When Neil Armstrong set foot on the moon in the summer of 1969, the Sacramento District Corps of En-



BETA I TEST STAND WITH MOCK-UP OF FLIGHT VEHICLE IN TEST POSITION. NOTE SIZE OF AUTOMOBILES FOR COMPARISON. (Ca 1965)

(Army Corps of Engineers Photo)

gineers recalled with pride their efforts in the partnership that allowed Armstrong to state, "That's one small step for man, one giant leap for mankind."

Besides its extensive involvement with missile support systems, the Sacramento District undertook military construction programs during the 1960s that nearly defy description. Not since the War had such a tremendous variety and volume of work in support of the Armed Services been accomplished. Two basic reasons are identifiable for the colossal growth of military work: (1) The uncertain and tense world situation due to such things as the Cuban Missile Crisis, the assassination of President Kennedy, American bombing of North Vietnam, Communist China's exploding its first atomic bomb, the Israeli-Arab six day war, North Korean capture of the USS Pueblo, the Tet offensive, the Soviet invasion of Czechoslovakia, North Korea's shooting down of an unarmed American reconnaissance plane; and (2) New responsibilities gained by the District during the sixties. (Office, Chief of Engineers assigned the Sacramento District all family housing design in the 6th Army Area, which included both North and South Pacific Divisions). From 1964 up to and including 1969, the District spent almost $200,000,000 for military construction, an average of over $32,000,000 for each of the last six years of the decade.

The following is a random list of typical construction jobs that may give a hint as to the diversity of projects completed in the 1960s.

1962

1. Radar Tower — Red Bluff AFS
2. 100-Man Fallout Shelter — Almaden AFS
3. Support Facilities for Fuel Cell Dock — Mather AFB
4. Heating Plant Addition — Hill AFB
5. Family Quarters — Dugway Proving Ground
6. Nike-Hercules Improvement Kit — San Francisco Defense Area
7. Finance Building — Fort Ord
8. Modification to Satellite Test Annex — Sunnyvale
9. Auto. Data Proc. Facility — McClellan AFB
10. Area Search Radar Facility — Travis AFB

1963

1. Re-Entry Vehicle Test Facilities — Green River, Utah
2. Chapel, Base Alterations and Photo Lab Alterations — Castle AFB
3. Rocket Motor Surveillance Facility — Hill Air Force Range
4. Academic Building — Presidio of Monterey
5. Dispensary and Dental Clinic — Oakland Army Terminal
6. Family Housing — Sharpe General Depot
7. Modification of Existing Intrusion Alarm Systems — 23 Nike Sites
8. Globecom. Facilities — McClellan AFB
9. Engineer Iroan Test Lab — Sharpe Army Depot
10. BOQ — Fort Ord

1964

1. Rehabilitation of Pier Facilities — Oakland Army Terminal
2. Officers Quarters — Hill AFB
3. Logistical Facility Depot — McClellan AFB
4. Parking Apron and Hoverpoint — Fort Ord
5. Runway, Overrun — Hamilton AFB
6. Enlisted Men's Mess Hall — Hunter Liggett
7. Hydrant Fuel Aviation-Fuel & Emergency Power Plant — Travis AFB
8. Wherry Housing — Presido of San Francisco
9. Dispensary & Dental Clinic — Two Rock Ranch Station
10. Guided Missile Surveillance Facility — Sierra Army Depot

1965

1. Photo Material Storage Facility — Defense Depot Tracy
2. Minuteman Engineering Test Facility — Hill AFB

3. Combat Vehicle Test Tract — Tooele, Utah
4. 100 Units Family Housing — Presidio of San Francisco
5. 190 Units Family Housing — Fort Ord
6. Regional Environmental Health Laboratory — McClellan AFB
7. Demolition of Bldgs. & Relocation of Lincoln Blvd. — Letterman Hospital
8. Bachelor Officer's Quarters — Sierra Army Depot
9. Emergency Power Supply — Middletown Radar Station
10. 550 Bed Hospital — Letterman — Presidio of San Francisco

1966

1. Logistical Facility Depot — Hill AFB
2. Hangars, Maintenance Engine Runup — Hill AFB
3. Logistical Facilities Depot — McClellan AFB
4. Sunnyvale Test Center Interim Expansion
5. Warehouse Mechanization — Defense Depot Ogden
6. Photogrammetric Mapping — Camp Roberts
7. Modification of Warehouse — Sacramento Army Depot
8. Drainage and Fencing — Golden Gate National Cemetery
9. High Altitude Training Building — Mather AFB
10. Bluelight Project and Fueling System — Beale AFB

1967

1. Ammunition Maintenance Facility — Sierra Army Depot
2. Chapel — Beale AFB
3. Preparation of Community Shelter Plan — Sacramento County
4. Test Range, Air to Ground — Hill AFB
5. National Fallout Shelter Updating Program Northern Callifornia
6. Library and Theater — Hill AFB
7. Rifle Squad Tactical Range — Fort Ord
8. Minuteman Engineering Test Facility — Hill AFB
9. Hospital Expansion — Ford Ord
10. Aircraft Care and Preservation Facilities — Sharpe Army Depot

1968

1. Student Dormitory with Mess — Presidio of Monterey
2. Hazardous Test Facility — Hill AFB
3. Aircraft Systems Test Facility Depot — McClellan AFB
4. Family Housing — Umatilla Army Depot, Vancouver, Washington
5. Squadron Operations (SAC) — Mather AFB
6. Cold Storage — Beale AFB
7. Runway and Lighting Repairs — Dugway Proving Grounds
8. 150 Units Family Housing — Presidio of San Francisco
9. Enlisted Men's Barrack Complex — Fort Ord
10. Composite Medical Facility — Mather AFB

1969

1. Airfield Improvements — Dugway Proving Grounds
2. Telemetry Building — White Sands Missile Range, Green River, Utah
3. Squadron Operations — McClellan AFB
4. Ammunition Maintenance Facility — Tooele Army Depot, Utah
5. Design of 100 Units Family Housing — Fort Huachuca, Arizona
6. Design of Improvements — Fort Lewis, Washington
7. 50-Man BOQ — Hunter Liggett Military Reservation
8. Surface Drainage System, Warehouse — Defense Depot Tracy
9. Shipment Processing Facility — Tooele Army Depot, Utah
10. Design of Western Medical Institute of Research — Presidio of S.F.

SR-71
(U. S. Air Force Photo)

These are meant only to be representative of the hundreds of projects (large and small), planned, designed and supervised by the personnel of the Sacramento District. Included among them are jobs whose value ranged from a few thousand dollars, to those exceeding sixteen million dollars. One of the biggest was initiated when Colonel Crawford Young, District Engineer, participated in ground breaking ceremonies for the $16,500,000 Minuteman II Engineering Test Facility at Hill Air Force Base in Utah. The facility is being used to update the ground support equipment and missile components for the Minuteman II ICBM. In contrast, Colonel Young and Colonel Robert Sauer, Commanding Officer of the 3535th Training Wing, turned the first shovels of dirt at similar ceremonies for a $934,000 gymnasium and dormitory at Mather Air Force Base. Very different from either of the above was the 550-bed Letterman Hospital, then under construction in September of 1967. This modern medical facility cost over $13,000,000.

Undoubtedly the most mysterious and at times intriguing construction project completed in the '60s was "Bluelight" at Beale Air Force Base. Roan Aicklen recalled the enigmatic representatives from Lockheed who would show up at the District to check on the progress of the special runway and support facilities necessary for "Bluelight." Roan remembers "it was awfully difficult to properly design appliances for something when precise specifications were not available."

Late in 1964 it was announced that Beale was to become the home of the Lockheed SR-71, which was finally revealed as "Bluelight." The "Beale Blackbirds," as they became known, were supersonic reconnaissance aircraft which could fly from Beale to Washington, D. C., in about an hour. The SR-71 squadrons were officially activated as the 4200th Strategic Reconnaissance Wing on January 1, 1965, but the first plane didn't arrive for another year. Later the 4200th was re-designated as the 9th Strategic Reconnaissance Wing.

The highly classified plane has a spectacular set of statistics. For instance, like Superman, it can travel faster than a speeding bullet, more than 3,100 feet per second. But unlike other Mach 3+ aircraft which can fly at very high speed for only brief periods, the SR-71 is capable of cruising for hours at super-supersonic speed at more than 80,000 feet. Constructed largely of titanium, the craft actually "grows" several inches after it has flown at ultra-high speed, and parts of the plane glow because of the terrific heat it generates as it smashes into the rarefied stratosphere more than fifteen miles above the earth.

During the closing years of the 1960s, after it was learned that Red China would soon be able to deliver atomic warheads to major U. S. cities via ICBMs, a great controversy grew around the type of defense that should be developed to meet the new threat. What was needed was an effective, yet economically feasible anti-missile capable of seeking out and destroying ICBMs launched against the United States mainland. Sentinel was the name applied to the Communist Chinese-oriented antiballistic missile system, which was really an outgrowth of the Nike series.

Late in November, 1967, meetings were held at ten locations throughout the nation to discuss proposed sites for the new weapon. Colonel Crawford Young, District Engineer, and Creed Card, Real Estate Division Chief, met at one such meeting with Utah's Governor Calvin Rampton, Salt Lake City officials and representatives of the Army Air Defense Command (ARADCOM) in Salt Lake City. At the meeting the ARADCOM officials presented a general description of Sentinel, what it was supposed to do, and how it might involve the community, Salt Lake City being one of the potential sites. A similar meeting was held in San Francisco during the summer of 1968 after it was announced that the San Francisco Bay Area might serve as another Sentinel site.

Sentinel was described as an area defense system, which would afford protection to all U. S. cities, not simply those near the missile sites. And because of their range, it was believed that relatively few sites would suffice to protect the entire country against the kind of attack Red China would be capable of by the

mid-70s. It was thought that some fifteen to twenty areas of the country were suitable for the proposed deterrent. Plans called for the first battery to be operational by the early '70s, with the remainder of the network standing guard five or six years later.

The summer of 1968 found District real estate personnel acquiring permits for right-of-entry, followed by other specialists undertaking electronic monitoring, core drilling, seismic tests and detailed surveys so that final site selections could be made. Meanwhile the controversy regarding the effectiveness and cost of the system became quite heated. Many were afraid that once a site was operational near their city the enemy would zero in on them to knock out the anti-missile system. Others protested that nothing could stop an ICBM anyway, that it would just be pouring billions down the drain to construct the network. In the end, public pressure halted the site selection work and the little bit of construction that had been accomplished.

Changing tactics, the Air Force scaled down its original proposal and tried to sell the idea of protecting only our own ICBM sites so as to ensure a retaliation capability in the event enemy missiles were aimed at our underground silos. The new anti-missile system was designated Safeguard. But, because of the Strategic Arms Limitation Talks (SALT), this system has, for the moment at least, also been shelved.

There can be no question in anyone's mind that the war in Viet Nam has dominated a great deal of American thinking since the early 1960s. Here again as in World War II and Korea, our blood and treasure have been poured out in defense of human life. No previous task in its long history has taxed the Army's Corps of Engineers more heavily than its chore in Viet Nam. Just as much, or perhaps even more than the Pacific battles during World War II, Viet Nam is an "Engineer's War." Thousands of civilian and military construction men have built more than a billion dollars worth of facilities since our involvement. Hospitals, roads, air strips, communication systems, ammunition dumps, fortifications, floating docks and housing have all been built by the Army Corps of Engineers under the most repugnant conditions. One of the more spectacular projects is the deep-water harbor at Cam Ranh Bay. Within a year, the Corps transformed a sun-baked wasteland into a modern harbor.

Indirectly, the Sacramento District has aided the war effort by building runways, supply, ammunition and repair depots throughout the western states, from which men and supplies are forwarded to the fighting area. The District has been directly involved in the war by sending its own men to Viet Nam. Most of the Army officers serving with the District have seen action in Southeast Asia, some on more than one occasion.

Civilians employed by the District have also volunteered for service in support of the national effort to aid the South Vietnamese. Included among the volunteers are Farold Thompson, Rex Williams, Edward Lyons, William Farrell, William Heyenbruch, Victor Schulman, Warren Sharp, Harold Moreton, Glenn Castle and Bill Doyle.

Hopefully, President Nixon's announcement of peace, made during January 1973, will signal the end of destruction and devastation and usher in a time of reconciliation and rebuilding throughout Southeast Asia. At this point in time, we can't know with any degree of certitude the course of future events, nor is it possible to foresee the impact the cessation of hostilities will ultimatley have on the military installations within the Sacramento District, and hence indirectly upon the military program of the District. Whatever tomorrow holds, one thing is certain, the Sacramento District stands ready to protect and preserve life here at home and to enhance our chances of success on the many troubled fronts the world over.

The emphasis of this discussion of military history has been, of necessity, a recounting of direct and indirect support afforded our armed forces by the Sacramento District since 1940. But we would ignore another vital function of the District if we failed to mention the life protection and life support facilities provided by

THE NEW LETTERMAN GENERAL HOSPITAL AT THE PRESIDIO OF SAN FRANCISCO (CALIFORNIA) WAS DEDICATED 14 FEBRUARY 1969. THE 550-BED, 10-STORY MEDICAL FACILITY WAS BUILT BY HALVORSON-McLAUGHLIN CONSTRUCTORS UNDER THE SUPERVISION OF THE SACRAMENTO DISTRICT, U. S. ARMY CORPS OF ENGINEERS, FOR APPROXIMATELY $15 MILLION. THIS IS THE MAIN ENTRANCE ON THE SOUTH SIDE OF THE BUILDING.
(Army Corps of Engineers Photo, 14 May 1969).

the Sacramento District. Since 1961, the District has assumed a leadership role in Civil Defense and National Fallout Shelter Programs. Working with private, local, state and federal agencies, District personnel have planned, implemented and expanded Civil Defense projects. During the fall of 1968, Sacramento District's civil defense boundaries were enlarged to cover all of Northern California and the states of Nevada and Utah. The boundary changes meant a modification in organization as well. The Civil Defense Section, formerly a part of the Military Branch, was abolished. In its place, a Civil Defense Support Branch was set up in the Engineering Division. The new branch contained the Disaster Assistance and Fallout Shelter Sub-offices located in Salt Lake City and in San Francisco. Over the years Sacramento has cooperated with other agencies to offer continuing programs of education and training to employees and the general public. The main thrust of their efforts is to develop plans for protection of life and property against the effects of either natural or manmade disasters: fire, explosion, earthquake, flood, nuclear attack or any other catastrophe which might befall our people. When District personnel answered the calls for help from the victims of the 1964 Alaskan earthquake, the recently formulated plans were given one of their first real tests. Since then the increased sophistication of the program has provided a measure of relief and recovery that reflects the dedication of the Corps of Engineers.

Besides providing an umbrella of protection for the general populace, the Sacramento District has constructed facilities that help rebuild the shattered bodies of our fighting men. Beginning during World War II, the District built hospitals throughout California and the West. But these were never meant to be permanent structures. Therefore, following the War, the Corps of Engineers planned and built some of the nation's first truly modern medical facilities. Under the auspices of the Veterans Administration, some eighty hospitals were authorized during the late 1940s to be built nationwide.

Jack English, in recalling the construction of the Fresno Veteran's Hospital, stated that:

> . . . unlike so many of our wartime projects, into which necessarily so much energy was expended, only to see them phased out, abandoned and demolished, here was one that would be designed and constructed in the very latest techniques (at that time) for the rehabilitation of the casualties of our wars. This was something very close to me, for I had been a front line stretcher-bearer in World War I, and therefore knew what it was all about.

In the fall of 1965, construction was begun on the new 550-bed Letterman General Hospital at the Presidio of San Francisco to replace a facility built in 1898. Four years later, on February 14, 1969 the new facility, the largest military hospital in the West, was dedicated. One of the most modern in the country, the $15,000,000, ten-story medical facility was completed under the supervision of the Sacramento District. Present at the dedication ceremonies and justifiably proud of their part in the project were Colonel (now General) George B. Fink, Sacramento District Engineer, and Frank Pieretti, Military Branch Chief.

Adjacent to the New Letterman General Hospital, the District is completing the Western Medical Institute of Research. When finished, this research center will be the largest facility of its kind in the western United States.

Prior to completion of the New Letterman Hospital, bids were opened in June, 1968, for the 440-bed Silas B. Hays General Hospital at Fort Ord. Three and a half years later, just a few days before Christmas 1971, dedication ceremonies were held to celebrate the completion of the new facility, the second largest hospital ever constructed by the District, Letterman being the largest. The $13,700,000 Fort Ord facility is an ultra-modern complex, the equal of any large metropolitan hospital.

Closer to home (Sacramento), the District has completed another, though smaller, medical complex at Mather Air Force Base. This $4,500,000 hospital was also begun in 1968, and offers its patients the very latest in medi-

THE ARMY'S NEW LETTERMAN GENERAL HOSPITAL, SAN FRANCISCO EACH OF THE SEVEN NURSING FLOORS HAS TWO SOLARIUMS — PATIENT RECREATION ROOMS WHERE THE VIEWS ARE SPECTACULAR. (MAY 1969)
(Army Corps of Engineers Photo)

MATHER AIR FORCE BASE $4½ MILLION, 105-BED MEDICAL FACILITY
C. E. Photo

cal treatment facilities. Housing 105 beds, the hospital has specialized clinics for radiology, cystology, urology, pediatrics, obstetrics, surgical and aerospace medicine. Like other medical facilities already completed or presently under construction, the new hospital replaces facilities built during the Second World War. Another project worthy of separate note is the three-story, split-level hospital which was begun at Hill Air Force Base in May of 1972. Scheduled for completion in 600 working days, this modern concrete and steel facility will provide a new measure of health care for the service personnel of this sprawling Utah base.

Probably more than any other type of construction project, hospitals reflect the emerging role of the Corps of Engineers in the field of military construction. No longer are thought and action limited to the engines of war and the systems that support them (rocket launchers, runways and fortifications); of equal concern are commodities designed to improve the human condition: hospitals, schools, homes, research centers, libraries and chapels.

In retrospect, it is a formidable task to comprehend the transition that has occurred in the field of military construction in the Sacramento District since those quiet days prior to Pearl Harbor. Not only has the District grown in the number and complexity of the kinds of projects it completes, but it has experienced phenomenal growth in the number of square miles of territory it administers. Beginning with the Central Valley of California in 1940, the District has over the years become the center of military design activities in the West. In 1961 it assumed design and construction responsibility for all the area previously under the jurisdiction of the San Francisco District. A decade later, in the summer of 1970, Sacramento acquired the military design work of the Los Angeles District, and both the military design and construction responsibilities of the Seattle District which had centralized responsibility for the entire North Pacific. For design alone the District's area of responsibility coincides with that of the Sixth Army which includes the states of California, Oregon, Wash-

SILAS B. HAYS GENERAL HOSPITAL
(Army Corps of Engineers Photo)

THE $526,000 CHAPEL CENTER, MATHER AIR FORCE BASE, SACRAMENTO, CALIFORNIA, WAS COMPLETED IN AUGUST 1969 UNDER THE SUPERVISION OF THE SACRAMENTO DISTRICT, U. S. ARMY CORPS OF ENGINEERS. COX, LISKE, LIONAKIS AND BEAUMONT, OF SACRAMENTO, WERE THE ARCHITECTURAL CONSULTANTS, AND NIMBUS CONSTRUCTION COMPANY, SACRAMENTO, BUILT THE PROJECT.
(USAF Photo, May 1970)

ington, Nevada, Utah, Arizona, Idaho and Montana and encompasses some 864,000 square miles. For design and construction, approximately 700,000 square miles make up the District's responsiblity, and give it the position of second largest in the nation for military work. Contracts in support of the military during the early 1970s mirror the ever increasing role assumed by the Sacramento District in the western United States. In the Pacific Northwest, work has been or is currently underway at the following installations: Seattle Defense Area, McChord AFB, Malmstrom AFB, Fairchild AFB, Fort Lewis, Yakima Firing Center, Fort Lawton, and Mountain Home in addition to the air bases, stations and depots already cited. From 1 July 1970 through 30 June 1971, 146 contracts worth $25.1 million had been awarded for military construction within the new boundaries of the Sacramento District.

These ever-increasing responsibilities weren't assigned to Sacramento by accident or chance, but because of demonstrated excellence. Colonel James C. Donovan summarized the quality of the District's personnel in his Christmas message of 1970: "Our opportunities for service now literally extend from the Rockies to the Pacific Ocean and from Canada to Mexico. We have this opportunity because of your outstanding professional abilities, selfless dedication to the public interest, and unblemished record of integrity."

CHAPTER VII
NAVIGATION PROJECTS 1940-1972

The importance of California's inland waterways for transportation was initially discerned by the Indians who plied the Sacramento and San Joaquin Rivers in fragile tule rafts and dugout canoes. Scattered above the flood plain were the villages of the Maidu, peaceful natives who found abundant food along the tree-lined waterways, the same streams that served as highways for the Indians. The Delta, however, was a different matter. The Indians, and later the Spanish, considered the region acceptable only for ducks and mosquitoes. Viewing this rich agricultural area as it now exists, it is difficult to visualize it as once being merely a broad, treeless swamp which served as a barrier to navigation. The early explorers often lost themselves in the maze of shallow delta channels as they searched among the tules and cattails for the mouth of the Sacramento River.

Except for the Spanish, the Russians from Fort Ross were the first white people to navigate the Sacramento and San Joaquin Rivers. As early as 1837, they sailed the rivers to bring supplies inland. One of the first, if not the first, steam-driven vessel to reach Sacramento was the tiny Sitka, which made the trip from San Francisco to Sacramento in *only* six days and seven hours.

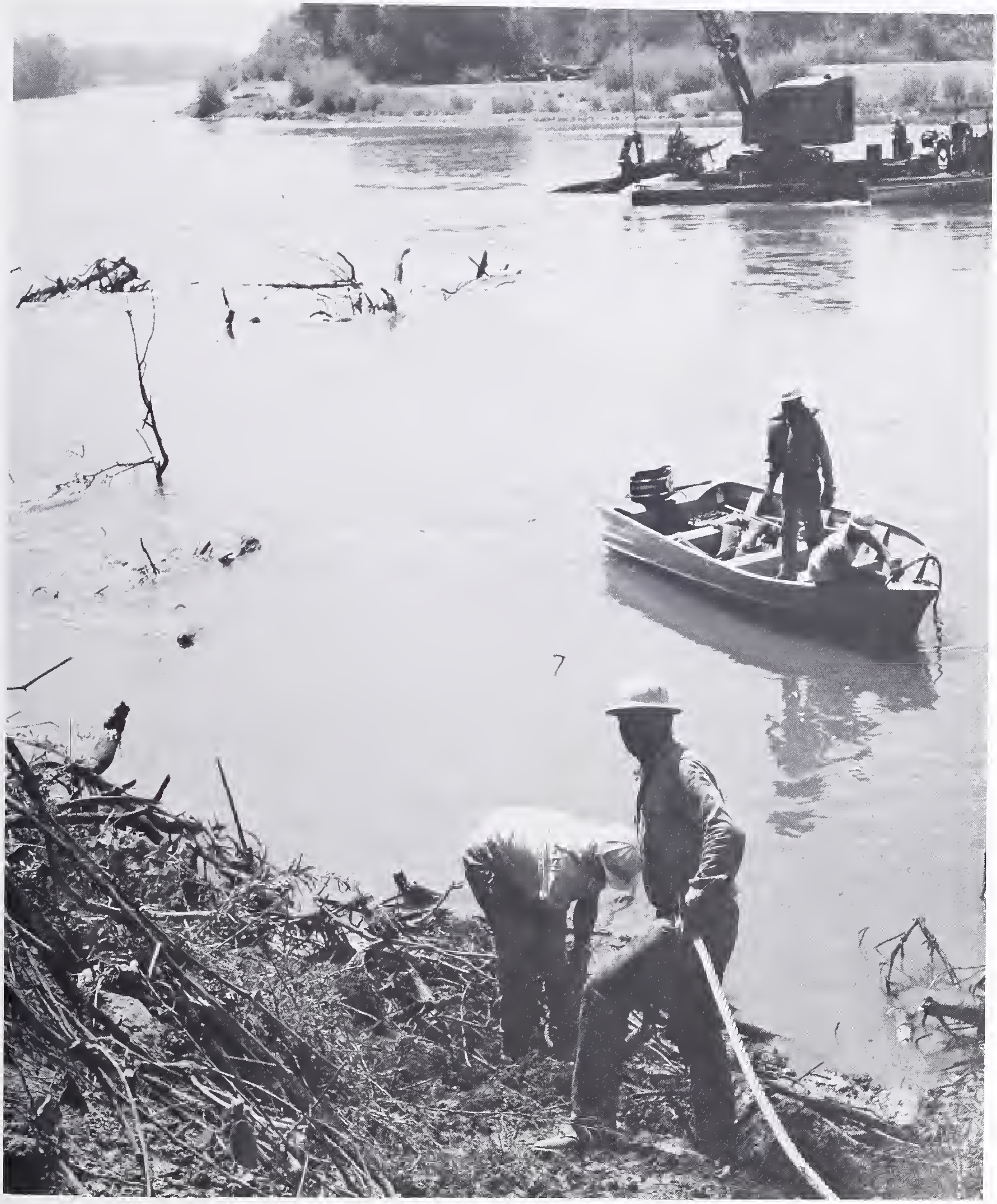
Permanent settlement of the region was assured with the arrival of a mixed bag of people in the fall of 1839. John Sutter with three other white men, some Hawaiians and an Indian boy, set up a camp near the junction of the American and Sacramento Rivers. Within two years Sutter had pretty much completed his famous fort. Named Nueva Helvetia, the settlement grew in importance, and soon became the hub of civilization in the then remote interior. Sutter's establishment of Sutterville in 1846, Marshall's discovery of gold in January, 1848, and the laying out of the City of Sacramento a month earlier by John Sutter, Jr., were the significant events that served as the prelude to the mass movement of men and supplies from the Bay to Sacramento, the jumping-off point for the mines.

The trickle of men during 1848 became the torrent of humanity of 1849, and the leisurely pace of river traffic was shattered by the collective wakes from all sorts of vessels making their way from San Francisco to Sacramento, and then on to Marysville. The first large steamboat to navigate the river was the *McKim* out of New Orleans, which brought a bunch of gold seekers to Sacramento in October of 1849. Because of the relatively poor condition of the river, it often took ten days to make the hundred mile trip from the Bay to Sacramento. Sailing vessels were especially vulnerable while navigating the river due to the strong current and calm weather of the Valley. Even so, vessels of considerable size could make their way to Stockton on the San Joaquin, and to points up river from Sacramento with little difficulty during periods of high water. During 1850 for instance, as many as 65 steam and sail boats tied up at Sacramento in a single day. River boats became such a part of the interior's economy that some became warehouses while at least one served as a jail.

With the advent and accretion of hydraulic mining, the river channels filled with muck and navigation was greatly impaired. Nonetheless, as the gold in the fields replaced the gold in the hills in importance and value, the rivers continued to be of vital importance as the chief means of transport until after the turn of the century. During the late 1880s, when California led the nation in wheat production, in excess of 50 million bushels of grain were transported annually on the rivers. But, with an ever increasing number of snags and sandbars collecting in the rivers and competition from railroads and trucks, commercial navigation on the Sacramento and San Joaquin gradually fell off.

The Corps of Engineers became involved with navigation on the Sacramento River through the River and Harbor Act of March 3, 1875. Work was authorized only a year later on the San Joaquin in an effort to improve navigation to Stockton. The original project (Sacramento River Shallow Draft Channel), has been modified by the Acts of 1882, 1889, and 1894. The present shallow-draft channel was authorized in 1899 and subsequently modified by the Acts of 1912, 1927 and 1935.

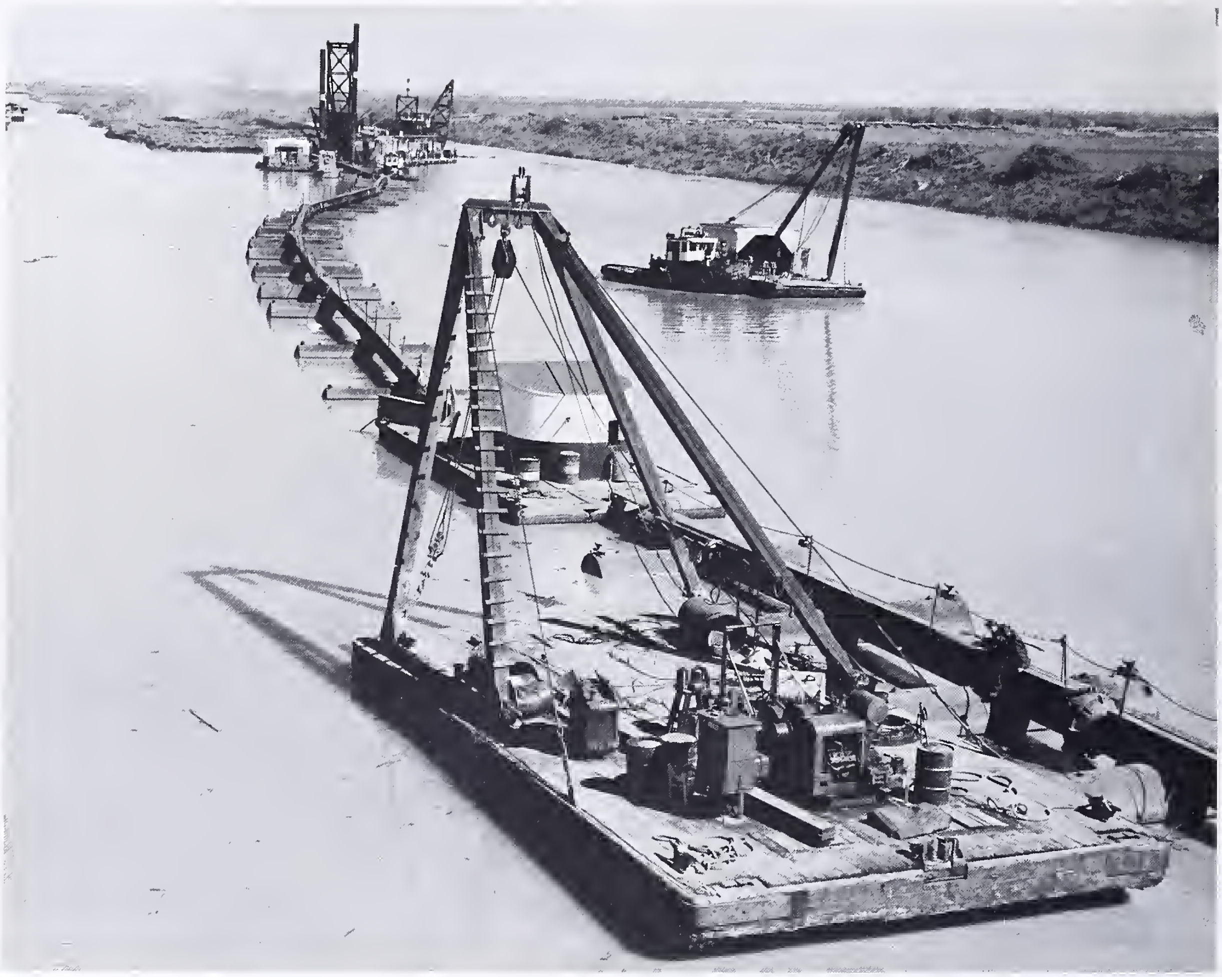
THE PADDLE WHEEL WORKBOAT, *PUTAH*, CHURNS UPRIVER. THIS CORPS OF ENGINEERS CRAFT WORKED ON THE RIVER AS LATE AS 1952.
(Photo – Gordon Spalding)



SNAGGING IN THE SACRAMENTO RIVER NEAR CORNING. (1965)
(Army Corps of Engineers Photo)

MILITARY SUPPLIES ARE MOVED BY TUG AND BARGE ON THE SWOLLEN SACRAMENTO RIVER.
(Army Corps of Engineers photo, 1969)

VETERAN POWDER SPECIALIST, BILL CHRISTY, LIGHTS A FUSE TO SET OFF AN EXPLOSIVE CHARGE. SOME SNAGS ARE IN AWKWARD POSITIONS AND BLASTING THEM OUT OF THE WATER IS THE ONLY PRACTICAL WAY TO GET RID OF THEM. A STATE FISH AND GAME REPRESENTATIVE IS PRESENT DURING ALL BLASTING TO INSURE THE MAXIMUM POSSIBLE PROTECTION FOR FISH. THIS IS THE SACRAMENTO RIVER NEAR VINA, CALIFORNIA.
(Army Corps of Engineers Photo, 1965).



CUTTING AWAY AT AN ISLAND IN A PROJECT STEP TO BRING DEEP SEA SHIPS 90 MILES INLAND FROM THE PACIFIC OCEAN TO THE SACRAMENTO VALLEY IN CALIFORNIA IS THE DREDGE "*PAPOOSE*." IT IS WORKING UNDER A CONSTRUCTION CONTRACT ISSUED BY THE U. S. ARMY CORPS OF ENGINEERS TO THE HYDRAULIC DREDGING COMPANY OF OAKLAND. THE "*PAPOOSE*," A 30-INCH SUCTION DREDGE, PUMPS STICKY CLAY MATERIAL AT THE RATE OF 1,100 CUBIC YARDS PER HOUR TO A SPOIL AREA THROUGH A 1,000-FOOT LENGTH OF DISCHARGE LINE RESTING ON PONTOONS. THE ANCHOR BARGES SHOWN IN THE FOREGROUND FLANK THE DISCHARGE LINE TO KEEP THE LINE AND DREDGE FROM SWAYING. THE DREDGE WAS ON THE HOMESTRETCH OF A $2,500,000 CONTRACT WITH THE SACRAMENTO DISTRICT FOR REMOVING SILT-DEPOSITED ISLANDS FROM DRAINAGE CHANNELS IN THE VICINITY OF LIBERTY ISLAND AND PROSPECT SLOUGH, LOCATED ABOUT 7 MILES NORTH OF RIO VISTA, CALIFORNIA. CLOSE TO 4,500,000 CUBIC YARDS OF MATERIAL WERE REMOVED UNDER THIS PHASE OF THE SACRAMENTO DEEP WATER SHIP CHANNEL PROJECT. THE CHANNEL JOB WAS ON THE DRAWING BOARDS AND UNDER CONSTRUCTION SINCE ITS AUTHORIZATION IN 1947. THE COST OF THE INLAND SEAWAY IS PLACED AT $40,000,000.

(Corps of Engineers Photo)

As has been noted earlier, the deep water channel to Stockton was authorized in 1927 and then enlarged by the 1935 authorization, and as we have seen, with few exceptions, the vast majority of navigation work on the Sacramento and San Joaquin Rivers, and in Suisun Bay was completed prior to the outbreak of the Second World War. Since that time the Sacramento District has maintained these navigation projects (Mokelumne River; Feather River; Old River; Middle River and connecting channels; Sacramento River shallow-draft project; San Joaquin River-Stockton Channel) and made improvements and enlargements to the turning basin at Stockton during the 1950s.

The major, single most expensive and most controversial navigation project completed since the war, or, in fact, ever constructed by the Sacramento District is the Sacramento Deep Water Ship Channel. We reviewed earlier how the City of Sacramento and other local interests had been fighting for such a project since just after the turn of the century. The Sacramento District Corps of Engineers became involved in 1933 when the U. S. Senate Committee on Commerce instructed the Chief of the Army Engineers to investigate the situation. Begun under the direction of Captain Drinkwater, District Engineer, a detailed study was prepared by the Sacramento District. But because of a number of factors, not the least of which was the war, the report wasn't released for a dozen years. Finally, after immense pressure from local interests, Congress authorized the project in the River and Harbor Act of July 24, 1946 (Public Law 525, 79th Congress, 2d Session). As finally adopted the project called for a 30-foot deep channel from Suisun Bay to an inland harbor at Sacramento, a distance of forty-three miles. In addition to the channel, a triangular harbor and turning basin at Lake Washington, a barge canal with a navigation lock to connect the harbor with the Sacramento River, and a single leaf combination highway and railroad bascule bridge across the canal at the harbor end of the navigation lock was also included in the project.

During the scores of years of endeavor by local interests, several possible routes were drawn for the hoped-for channel. One of the more interesting suggested that the route follow the San Joaquin River to a point near the mouth of the Mokelumne, then by canal to the Sacramento River to an area near its junction with the Cosumnes River. Then, a cut would be made through low land to a harbor facility to be prepared in the vicinity of William Land Park in southwest Sacramento.

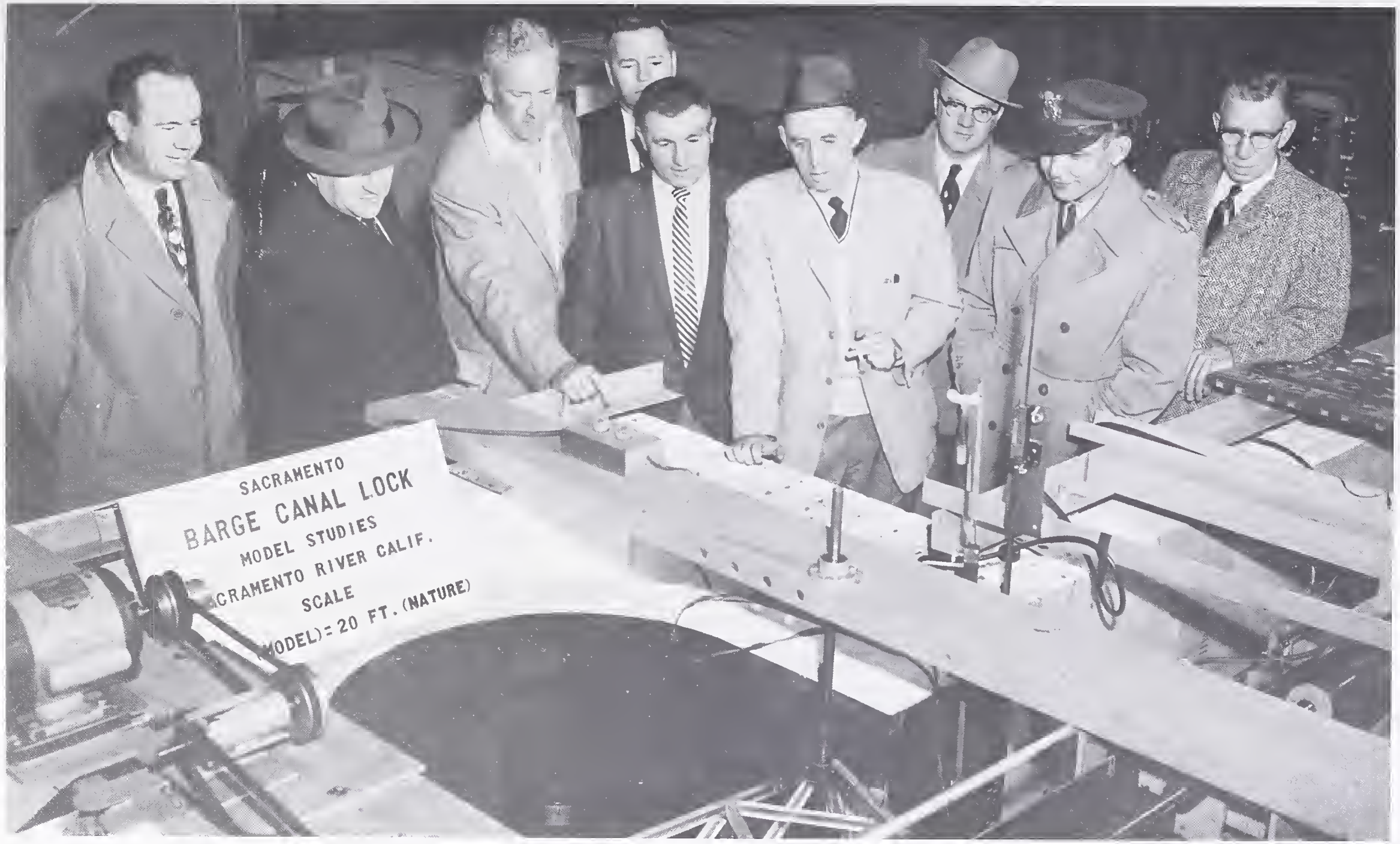
As authorized, the channel leaves the Sacramento River at Cache Slough and then proceeds almost due north in a straight line that runs west of the twisting and turning Sacramento River. As it nears Sacramento, the channel makes a slight bend to the left and then a bit later to the right, ending in the harbor.

In digging the new facility, the Corps widened and deepened existing channels from Suisun Bay through the Sacramento River and Cache Slough, a distance of about 18 miles. The last 25 miles were excavated through fields on Prospect Island, Little Holland Tract and the Yolo Bypass.

Federal first cost for the project was just under $40,000,000 but state and local interests have made substantial contributions as well. As early as 1942, the Sacramento Chamber of Commerce decided to aid the Corps of Engineers and raised some one hundred thousand for research and promotional activities. Of the total, the City of Sacramento appropriated $25,000, the County matched this amount, while $42,500 was pledged by individual businessmen. The remaining $7,500 was contributed by the Chamber of Commerce.

After the District and the Division reported favorably to the Chief of Engineers in June, 1945, and following his review and approval, Congress authorized the project. At the same time, they divided the cost between the federal government and local interests in the following manner: The Corps of Engineers would do the initial dredging and excavation, and maintain the channel after its completion; local interests would be required to provide all rights-of-way, relocate utilities, provide belt railroads, and

SACRAMENTO DEEP WATER CHANNEL UNDER CONSTRUCTION. (Ca 1961)
(Sacramento Bee Photo)



CORPS OF ENGINEERS PERSONNEL RESPONSIBLE FOR DESIGN AND CONSTRUCTION OF THE SACRAMENTO BARGE CANAL LOCK MET AT THE WATERWAYS EXPERIMENT STATION AT VICKSBURG, MISSISSIPPI, DURING JANUARY 1957. PICTURED ARE (LEFT TO RIGHT): F. R. BROWN, WATERWAYS EXPERIMENT STATION; J. C. HARROLD, OFFICE, CHIEF OF ENGINEERS; T. E. MURPHY, WATERWAYS EXPERIMENT STATION; J. H. ABLES, JR., WATERWAYS EXPERIMENT STATION; F. KOCHIS, SACRAMENTO DISTRICT; W. C. CASSIDY, SOUTH PACIFIC DIVISION; J. B. TIFFANY, WATERWAYS EXPERIMENT STATION; LIEUTENANT COLONEL LOOP, SACRAMENTO DISTRICT; AND H. F. PETERSON, SACRAMENTO DISTRICT, ALL OF THE CORPS OF ENGINEERS, U. S. ARMY.
C. E. Photo

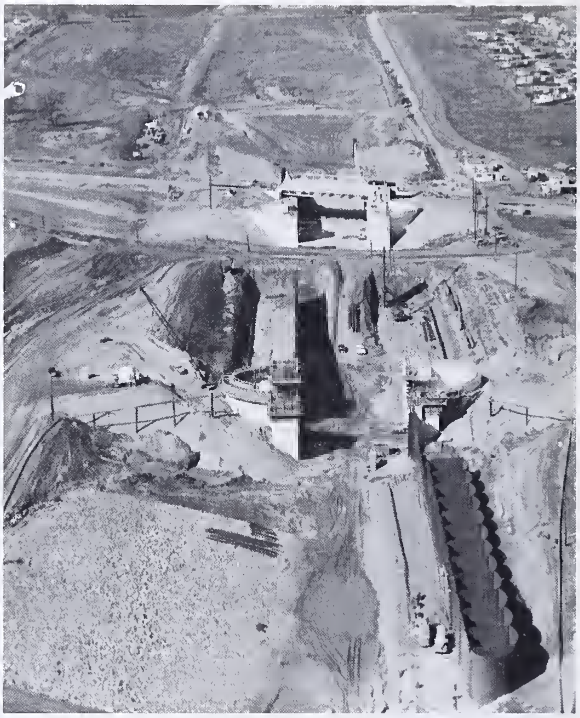
construct proper terminal facilities.

In the spring of 1947, local residents formed the Sacramento-Yolo Port District. Later the same year, the State of California approved the project and appropriated seven hundred fifty thousand dollars so that the newly created port district could purchase rights-of-way, easements and other necessary properties. On November 4, 1947, the sale of $3,750,000 worth of general obligation bonds was authorized to finance construction of terminal facilities. By the time the project was dedicated in 1963, local interests had spent $4,072,000 to comply with requirements exclusive of terminal facilities. The cost of basic terminal facilities amounted to about ten million, seven hundred thousand dollars. Moreover, the State rebuilt the Rio Vista bridge to accommodate ocean-going vessels, at a cost of more than $3,000,000.

With design completed and construction drawings ready, the Sacramento District began moving dirt in July, 1949. The first job completed was construction of levees in the harbor area. During 1950-51, the Engineers completed work in Cache Slough adjacent to the Egbert Tract. At this point, some four and one-half miles of the ship channel were completed to final design standards. It was hoped that the channel and harbor would be completed by about 1953. But such was not to be. With the outbreak of the Korean War in the summer of 1950, work on the project was suspended.

Work was resumed in 1956. When completing design studies for the lock in the barge canal, District personnel borrowed from the experience which had proved successful in the construction of the Algiers Lock, located just south of New Orleans. Modifications necessary to fit the special requirements in Sacramento were checked out on a working model at the Waterways Experiment Station at Vicksburg, Mississippi.

Finally, at noon on July 19, 1963, after many delays and fourteen years since the first shovelful of dirt was turned, the project was dedicated. At the time, special mention was made of the fact that Bill Clark, who handled the ship channel project for the District, had probably supervised more earth moving than any man in the West. He began with the Stockton Channel in 1932 and later supervised the compaction of earth fill at Folsom Dam. During the War he supervised construction of Chico Army Air Base and the extensive railroad classification yard at Roseville.



BARGE CANAL LOCK UNDER CONSTRUCTION.
(Army Corps of Engineers Photo)

With the completion of the Sacramento Deep Water Channel, the Sacramento District added still another important project to its growing list of accomplishments designed to help residents of the West maintain one of the highest standards of living ever known.

The completion of the project meant a great deal to Sacramentans and they held one of the biggest celebrations ever to mark the event. Secretary of the Interior, Stewart Udall, was the principal speaker at the dedication ceremonies. Another important participant in the celebration was Major General Robert G. MacDonnell, Deputy Chief of the Army Engineers. Earlier, he had been Division En-

SACRAMENTO DEEP WATER CHANNEL, JULY, 1961
(Army Corps of Engineers Photo)

gineer, South Pacific Division, and was closely associated with the construction. Colonel H. N. Turner, District Engineer, was particularly proud of the District's role in the project, as was Lieutenant Colonel C. R. Teagle, Deputy District Engineer, who frequently checked construction progress with Wesley South, recently appointed project engineer.

It seemed everybody had something to say or write about the channel. Congressman John Moss recounted his part in getting the work completed, and his occasional disappointment with the Corps of Engineers. He recalled how he worked tirelessly to circumvent an early Corps of Engineers' study that reported the cost-benefit ratio of the then proposed port to be .98 to 1, which meant the returns from the port would amount to only 98 cents for each dollar invested.

W. G. Stone, Port Director, enjoyed a great feeling of success because he had been pushing very hard for the facility for nearly forty years. You might remember that he and Colonel Jackson didn't always see eye to eye on the Port question during the 1930s. Senator Clair Engle recalled in detail how he had supported the project since 1943. He believed that the economic significance of the facility extended beyond California to all of the western states. Senator Thomas Kuchel called the new port, "A monument to the faith which the people of the community have in the future." Complementing the Sacramento District, he stated that they were, ". . . highly competent engineers of the United States Army . . ."

Prior to the official opening of the deep water channel, the *Harbor Prince,* a sightseeing boat from San Francisco, came up the channel on May 11, to become the first vessel to dock at the new Port of Sacramento. To get things under way officially, however, Sacramento held a reception on Thursday, July 18th, followed by a parade and dedication during the following two days. All in all, it was quite a celebration.

Following the completion of the deep water channel, a small but related navigation project was authorized in 1963 and completed in 1964. In the main, the work amounted to deepening and widening the existing Suisun Point and Bulls Head Channels in the Carquinez Strait and Lower Suisun Bay. The improvement affords additional maneuvering space for deep-draft vessels so as to alleviate dangerous collision and grounding hazards, and created a settling basin to reduce shoaling of the main navigation channel.

A huge navigation project authorized in 1965 is the John F. Baldwin and Stockton Ship Channels. Total first cost of the project is estimated at $62,900,000 (July 1970 prices), which is exclusive of $470,000 for Coast Guard navigation aids. Preconstruction planning was completed during Fiscal Year 1969. The massive project will involve both the San Francisco and Sacramento Districts, and will mean modifications to most of the existing navigation projects from San Francisco to Stockton. The San Francisco Harbor Project, the Richmond Harbor Project, the San Pablo Bay and Mare Island Strait Project, the Suisun Bay Channel Project, and the San Joaquin River Navigation Project will all be deepened, widened, realigned and/or in some way modified and improved. In addition, turning basins, maneuvering areas, recreation areas and other new work will be completed within the perimeters of the enormous navigation project, named in honor of one of California's most revered congressmen.

The first concern of the federal government in the river systems of the Central Valley was maintenance of navigation. The need for such was created by the deposition of mining debris in these channels, and to keep pace with the West's rapid development, additional navigation projects have been authorized during the last 98 years. These projects cover about 500 miles of more than 1,500 miles of waterways available for navigation throughout the Sacramento River, San Joaquin River, Delta and tributaries of these rivers and channels. Presently, the maintenance activities receiving the highest priority are those associated with the deep water ship channels and consist mainly of dredging. Snagging, clearing, control of mining debris, repair and rehabilitation of wing dams, maintenance of spoil areas and other

THE SACRAMENTO RIVER DEEP WATER SHIP CHANNEL BEING USED BY TUG AND BARGE. THE 25-MILE LONG CHANNEL, BUILT, MAINTAINED, AND OPERATED BY THE SACRAMENTO DISTRICT, U. S. ARMY CORPS OF ENGINEERS, CONTAINS THE ONLY NAVIGATION LOCK IN CALIFORNIA.
(Army Corps of Engineers Photo)

PUSHBOAT PROCEEDING PAST SACRAMENTO PORT AND ON INTO SACRAMENTO DEEP WATER SHIP CHANNEL BUILT BY THE SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS.
(Army Corps of Engineers Photo)

LOOKING WEST, SACRAMENTO RIVER IN FOREGROUND. PORT OF SACRAMENTO IS SEEN IN UPPER LEFT CENTER OF PICTURE. THE LARGE EXPANSE OF WATER IN THE BACKGROUND IS THE YOLO BYPASS DURING FLOOD. THE COAST RANGE MOUNTAINS CAN BE SEEN AT THE VERY TOP OF THE PICTURE.
(Army Corps of Engineers Photo)

miscellaneous work make up the remainder of the navigation work. With the present trend toward larger vessels requiring deeper channels, it is probable that projects encompassing standards to meet these requirements will be completed in the years to come. But, as has been pointed out earlier, we must never assume that the needs of navigation can be separated from the concerns and plans for the river system as an integrated whole, i.e. irrigation, flood control, power development, and recreation. It is to these other areas that we now turn our attention.

A VINEYARD NEAR MANTECA, CALIFORNIA (Ca 1969)
(Army Corps of Engineers Photo)

MARYSVILLE, CALIFORNIA — DECEMBER, 1955
(Army Corps of Engineers Photo

CHAPTER VIII
HARNESSING THE RIVERS: PERSPECTIVE

Early settlers of California and the West were unmindful of the potential destructive force of the rivers of the region. So they built their homes, farms and cities in the forks of the Valley's great streams, on the flood plains and finally on reclaimed swamp lands. The natural danger of the situation was increased by the hydraulic miners who were soon clogging the channels with millions of cubic yards of debris. Having had their own way for countless millennia, the rivers weren't going to give up their natural territory without a struggle. They struck back again and again! Towns and cities of the Great Central Valley were often under several feet of muddy water before their planning stages were completed.

As long as the region was sparsely settled, the loss of life and property was not extensive. Certainly people died, homes and farms were destroyed but generally people of the Valley took the disasters in stride and learned to live with the situation, at least for a while. Instead of moving to higher ground, people leveed against the rivers and took to boats when the levees failed. Sacramento residents endeavored to remedy the situation not only by putting up levees, but by raising the level of their streets. A unique solution indeed, but of little lasting value.

Only a decade after entering the Union, Californians learned of the foolishness in building on the flood plains. The great winter floods of 1861-62 were unprecedented in modern memory. Rivers crested, spilling their destructiveness over the banks, making an inland sea of the Sacramento and San Joaquin Valleys. The huge lake was 250 to 300 miles long and from 20 to 60 miles wide, and in some areas water lapped over the tops of telegraph poles. Floodwaters seemed to cover everything, spreading ruin, devastation and disease over thousands of square miles; creeks and arroyos, dry most of the year, became angry torrents; and every low-lying area became a lake. Business and transportation (other than by boat, which proved extremely dangerous) simply came to a standstill; cattle and other livestock perished by the tens of thousands; and it has been estimated that as much as a fourth of the state's taxable wealth was lost.

Having paid their sacrifices to the river gods, the populace suffered an even crueler blow from the two years of extreme drought that followed the great flood. Misery from the rains on the southern ranges was inconsequential when compared to the appalling losses caused by the almost complete absence of moisture for some 600 days. Pastures became deserts, the earth iron, and the sky turned to brass. The animals not drowned the previous year shriveled and died on the sun-baked ranges. Carcasses lay in heaps about the dry water holes and sand-choked springs. And then, as if sent by a displeased god, swarms of locusts blackened the skies of California's great valley, eating any remaining vegetation. To climax the devastation, a virulent plague of smallpox gripped the land, sending spears of terror into every village, rancho and city of the south. Particularly hard hit were the Indians, who seemed to vanish in the face of the collective catastrophe. Forbidding heaps of bones and skeletons, everywhere bleaching in the sun, symbolized the ruin of southern California.

The flood and drought of the early '60s were only the first among many to be recorded since California and the West had been taken and held by Americans. The flood of '75 is significant in that for the first time it was proven beyond reasonable doubt that hydraulic mining debris was adding to the intolerable natural conditions. Disaster struck on the night of January 19, 1875. After being filled for weeks by rain and snow, the Yuba River went over the levees at Marysville, and by the next afternoon the town was a huge bowl of brown water. When the water finally receded, it was discovered that the town had become a dump for massive quantities of mining debris.

We learned earlier that the agriculturalists defeated the miners in 1884 with the Sawyer decision. But not even Judge Sawyer could halt the rain and snow, nor could he conserve needed water for the years of drought. Neither could an injunction stem the flow of debris already placed in the stream channels. While the Almighty still has something to say regarding the kind and amount of moisture that will

YUBA CITY, CALIFORNIA — DECEMBER 1955
(Army Corps of Engineers Photo

YUBA CITY, CALIFORNIA — DECEMBER 1955
(Army Corps of Engineers, Photo)

bless or distress the land, and when and where it will arrive, the Corps of Engineers has accomplished a great deal to guide, conserve and utilize this all-important natural resource.

Out of the studies of the 1870s and 1880s came the "Act to Create the California Debris Commission" on March 1, 1893. From this the groundwork was laid for the flood control projects of today. Moreover, a long while before it was considered a national responsibility, flood control work was initiated through specific legislation meant to solve common problems on the Sacramento and Mississippi Rivers. Throughout the first quarter of the twentieth century, most of these activities along the main stems of the Sacramento and San Joaquin were conducted by the California Debris Commission, and later by the Sacramento District. Then, in 1927, the District (Second San Francisco District) was instructed to conduct the "308" studies, a physical and economic survey of all the water resources within its area of responsibility. These, in turn, have become the foundation, the basic blueprint, for all flood control development within the District.

To further clarify and demonstrate the pressing need in past years for flood control works, and to a lesser extent today, let us examine two tragic events; both resulting from floods due to levee failures. Perhaps by viewing natural calamities in terms of human suffering we will gain an appreciation of the efforts, of the past and present, put forth by men and women of the Sacramento District to prevent or at least minimize similar destruction.

Four minutes after midnight on the bleak morning of December 24, 1955, the levee protecting Yuba City failed to hold. The break occurred near Gum Tree Station, just upstream from Shanghai Bend and about two miles south of Yuba City. The open country in the area of the break was at least 25 feet below the crest of the levee; hence, when the barrier collapsed, the Feather River gushed through the breach in a torrent, which chewed an ever bigger hole in the levee. Destruction rushed toward the town in the guise of a wall of water up to 30 feet high. Striking the outskirts violently, it tended to flatten out as it entered and passed through the town. Before it was checked, 100,000 acres were covered. While more than half the entire state was hit by flooding to some degree, the Yuba City flood constituted the greatest single disaster. Viewed state-wide, the flood of December, 1955, was the greatest disaster of its kind ever to occur in California. It was rated as the worst misfortune of *any* kind since the earthquake and fire in San Francisco in 1906.

Thirty-eight people died and 3,227 were injured as a direct result of the levee break and flood. Four hundred and sixty-seven homes were totally destroyed and another 5,745 damaged. In all, 8,500 families suffered tangible losses. Destruction in Sutter County alone was estimated between $35,000,000 and $40,000,000. In terms of human suffering, it's impossible to place a price tag. Men toiled unceasingly to save their homes, only to see them swept away or filled with mud. Often women and children spent hours in the icy waters before they were rescued. Twelve thousand residents were evacuated and had to spend days and often months away from their homes. How does one measure terror? It's ironic that for days the major concern had been not Yuba City, but Marysville, which had become an island in a sea of angry water. For hours before the levee broke, people huddled near their radios, listening to announcements relating to the battle to save the levee. In the end, the levees protecting Marysville, though battered and weakened, held. Suddenly the point of focus changed. Amid confusion and fear, mothers and fathers grabbed their children, got into their cars and raced to safety.

Many did not escape. Three men of the Sutter County sheriff's staff, Earl Blackburn, his son Robert, and John Talley, perished while warning people of the coming danger. Three other men working on the levee near Gum Tree Station were caught by the raging current. Others died in their homes. A score were trapped when their cars were submerged by the flood. Of the bodies recovered following the flood, the youngest was that of Robin Darlene Ethington, only 3 years old. The eldest was that of E. W. Hudgens, age 82.

***"KISKA"* ASSISTING ARMY ENGINEER TROOPS PLACE CANVAS ON YUBA CITY LEVEE.**

Along with hundreds of others, men of the Sacramento District battled the flood at Yuba City during the disaster. Existing levees often developed soft areas that crumbled easily under pressure of the flooding rivers. Men of the Sacramento District devised a system of placing tarpaulins over the banks until they appeared secure. By working day and night, Colonel Wilder, Acting District Engineer, and his men did all that was humanly possible to preserve life and property. They stayed on for months rebuilding the broken and damaged levees.

Meanwhile, downstream on the Sacramento, residents of every Delta island were waging their own battles for survival. Here too, hundreds of men worked incessantly, shoring up the levees with everything from sandbags to bulldozers. Sometimes they won. Sometimes their efforts weren't enough. And, before their ordeal was over, Delta residents endured several days of anxious waiting. This was especially true of those who lived in Isleton, a small town on the lower Sacramento. The levees protecting the town had been seriously weakened and arrangements were made to evacuate the entire population. While other islands were lost to the flood, Andrus-Brannan Island, on which Isleton is situated, was saved.

Some 16 years later, Isleton's luck ran out at midnight on the morning of Wednesday, June 21, 1972, when the Delta suffered its most recent disaster. For, at that moment which separates one day from the next, a Reclamation District levee failed, allowing some 200,000 acre-feet of water to pour over Andrus-Brannan Island. It wasn't the first time the levees failed and it won't be the last. The Andrus-Brannan levees were built in 1872-1873, and have failed in 1878, 1879, 1881, 1902, 1904, 1906, 1909 and 1972. The story is pretty much the same for the rest of the islands of the Delta.

Upon receipt of the news of the break, the Sacramento District was immediately mobilized. Colonel James Donovan, District Engineer, headed up an inspection party and flew by helicopter to the crippled area. Construction Division Chief, Ellis McKinsey, mobilized contractors, and before long, trucks were hauling in fill material in a desperate race against time and tide. Isleton, like the rest of the Delta, is below sea level; hence, to save the town, a dike had to be thrown up over a mile in length and to a height of up to eight feet. Before long the water had reached the temporary works and they had to be strengthened by additional rock and earth. To prevent raw sewage from contaminating the drinking water, the District supervised the construction of another dike surrounding the city's sewer plant. Courageous volunteers and paid flood fighters used thousands of sandbags and truckloads of plastic sheeting in a feverish, last-ditch stand to save the town. Bill Calvin, Resident Engineer for the Valley, set up an office in Isleton from which he directed the contracted work throughout the night. In the end, the rivers had won again; the emergency dikes were overtopped by the Delta waters. It should be noted that this all took place in the middle of a rather dry summer, not during a winter flood. The consequences are the same; property is lost, and the suffering is endured. So, regard-

A GRAPHIC EXAMPLE OF LEVEE EROSION ATTRIBUTABLE, IN EVER-INCREASING CASES, TO THE WAVE ACTION PRODUCED BY BOATS AND WATER SKIERS.
(Sacramento Bee Photo by Frank Stork – 19 July 1970)

FARM FLOODED AT SHERMAN ISLAND — JANUARY 27, 1969

(Army Corps of Engineers Photo)

less of the underlying causes of flooding, the need for flood control works remains, even though much has already been accomplished.

Too often, when gauging the relative merits of a particular project, men have thought in terms of crops, land values, dollars spent and saved, and political consideration. Perhaps there ought to be a larger category given to potential human suffering. The above examples are only two of hundreds of similar incidents that might be cited, and are meant only to be illustrative of the types of problems present within the Sacramento District.

PROJECTS AND PLANS

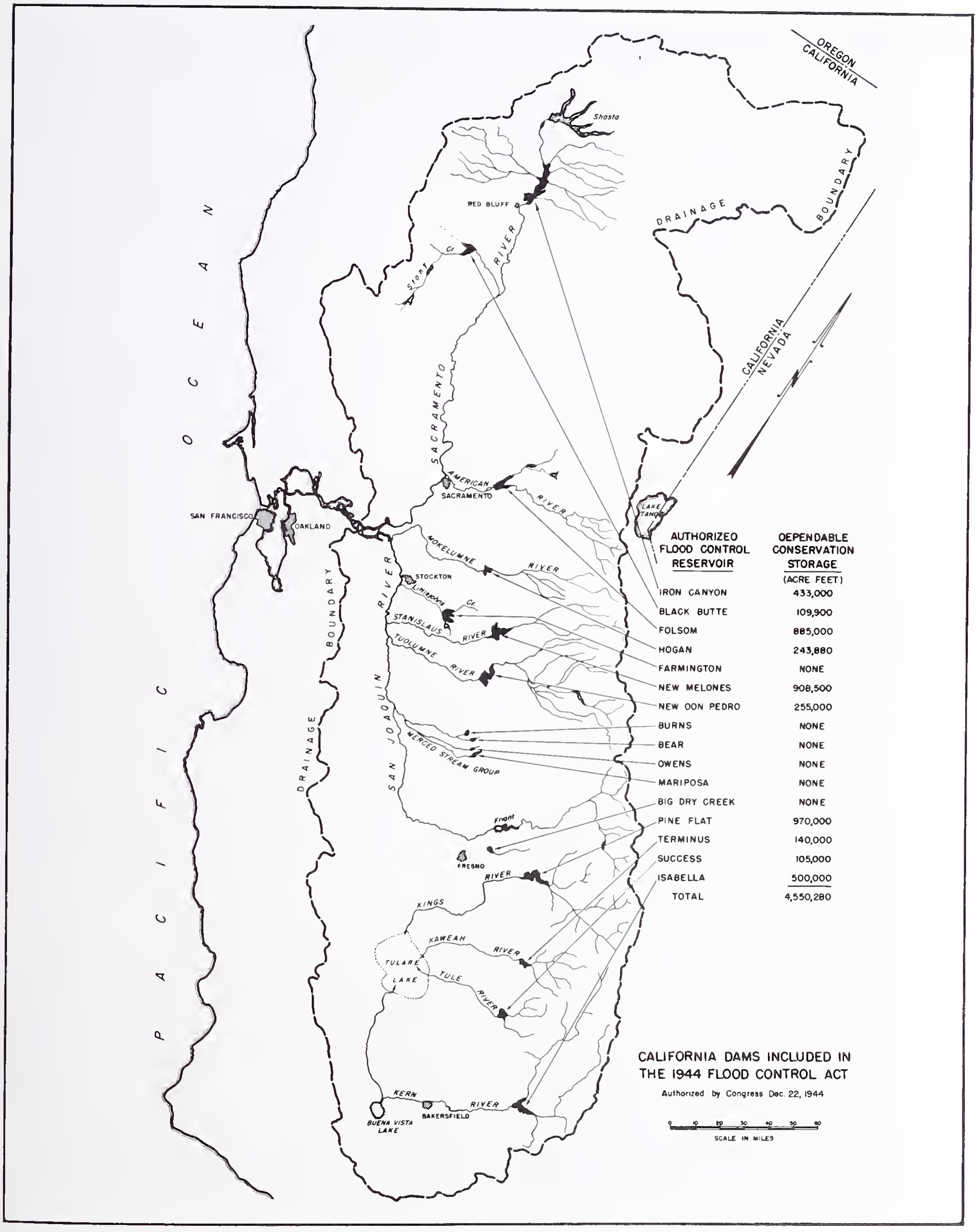
Prior to the War, flood control projects consisted mainly of enlarged channels, levees, weirs and bypasses. After the War, the emphasis became focused on large multiple purpose dams, the idea being to stop or at least slow down and control the excess flows so that existing channels could cope with measured releases. For years the Sacramento District had studied and laid plans to harness the major tributaries of the Sacramento and San Joaquin Rivers, but the attack on Pearl Harbor suspended all thoughts of civil works. By late 1944, however, most Americans believed the Nazis were whipped and hoped that Japan would soon be brought to her knees. Congress, too, shared these feelings and decided to take steps to ensure adequate employment for the returning veterans while bringing to fruition the years of civil works planning. A few days before Christmas 1944, Congress passed the Flood Control Act of 1944 (Public Law 534, December 22, 1944, 78th Congress, 2d Session). Not since the Depression had a public works program of such magnitude been authorized. Included in the work to be accomplished were sixteen dams, miles of levees and extensive channel improvements within the District. When word reached the Sacramento District Office, people were so excited that they went to lunch, spent the afternoon celebrating and didn't return to work until the next day.

Unfortunately, there was a hitch in American optimism. Hitler didn't know he was beaten. In the cold foggy dawn of 16 December, the Fifth and Sixth Panzers, and the German Seventh Army swept through the Ardennes on a 40-mile front, smashing all resistance. For a time no one was quite sure when or where they could be stopped. Operations charts showed the German penetration as a huge bulge in the Allied lines, hence the engagement was soon known as "The Battle of the Bulge." Unable to crush the surrounded city of Bastogne, or to capture any large American fuel supplies, the Germans literally ran out of gas and were stopped just four miles from the Meuse River by American and British units. Meanwhile, General Patton's Third Army struck a crushing blow against the south flank of the Bulge on 22 December, the same day Congress passed the flood control legislation. While the outcome was never in doubt, the adversaries paid an awful price in testing each other's strength. The Germans suffered more than 200,000 casualties, while the Americans lost almost half that number. Clearly, the war was not over! Another five months of intensive fighting took place before the Germans surrendered on May 7, 1945. VE Day was celebrated in every Allied country, but there was little cause for rejoicing in the Pacific and Asia. The Japanese weren't aware they were whipped either. Even so, the end was near.

At 9:15 A.M. on the 6th of August 1945, an atomic bomb was toggled out of the belly of the "Enola Gay" at an altitude of 31,600 feet over Hiroshima. Within seconds, 60,175 men, women and children were disintegrated along with their city. Not quite a month later, on 2 September 1945, surrender documents were signed on the deck of the battleship Missouri, only a few miles from where Commodore Perry's treaty had been signed ninety-two years earlier. Now the war was over and the construction authorized during the Christmas holidays of 1944 could get underway.

PINE FLAT

The first reservoir and dam project to get underway in the District as a result of the 1944 Act was located at Pine Flat on the Kings River, about twenty-five miles east of Fresno. The location occupies one of the last great nat-


CALIFORNIA DAMS INCLUDED IN THE 1944 FLOOD CONTROL ACT
Authorized by Congress Dec. 22, 1944
AUTHORIZEO FLOOD CONTROL RESERVOIR
OEPENDABLE CONSERVATION STORAGE (ACRE FEET)
IRON CANYON 433,000
BLACK BUTTE 109,900
FOLSOM 885,000
HOGAN 243,880
FARMINGTON NONE
NEW MELONES 908,500
NEW OON PEDRO 255,000
BURNS NONE
BEAR NONE
OWENS NONE
MARIPOSA NONE
BIG DRY CREEK NONE
PINE FLAT 970,000
TERMINUS 140,000
SUCCESS 105,000
ISABELLA 500,000
TOTAL 4,550,280
SCALE IN MILES
PACIFIC OCEAN
OREGON
CALIFORNIA
CALIFORNIA
NEVADA
DRAINAGE BOUNDARY
Shasta
RED BLUFF
SACRAMENTO RIVER
Stony Cr.
AMERICAN RIVER
SACRAMENTO
LAKE TAHOE
SAN FRANCISCO
OAKLAND
MOKELUMNE RIVER
STOCKTON
STANISLAUS RIVER
TUOLUMNE RIVER
SAN JOAQUIN RIVER
MERCED STREAM GROUP
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KINGS RIVER
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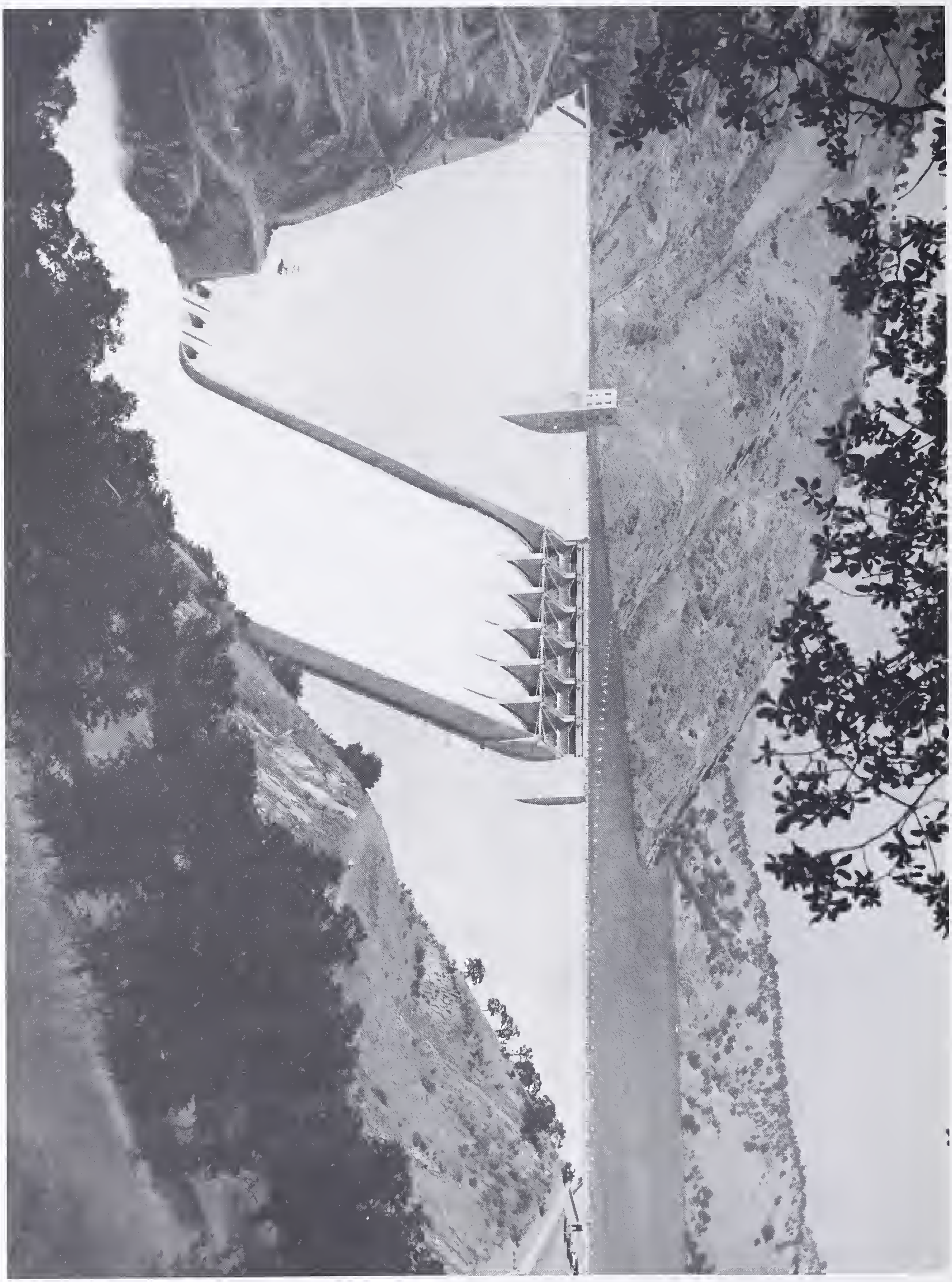
BAKERSFIELD
BUENA VISTA LAKE



PINE FLAT DAM

(Army Corps of Engineers Photo)

PINE FLAT: ONE OF THE LAST GREAT NATURAL DAM SITES ON THE SIERRA FRONT. THIS IS THE SITE OF THE DAM, ON THE KINGS RIVER, FRESNO COUNTY, PRIOR TO CONSTRUCTION.

(Army Corps of Engineers Photo)

ural damsites in the western Sierra. As such, it has been an obvious position for a barrier since very early days. Who originally saw it as such is difficult to say, but it is known that it was mentioned in a "Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California," signed and sent to Congress by President Grant on March 23, 1874. The Commissioners were Barton Alexander, Lt. Col., Corps of Engineers; George Mendell, Major, Corps of Engineers; and Professor George Davidson, of the U. S. Coast Survey. Their report laid most of the essential groundwork for later studies and plans for the project.

Contemporary engineering studies which finally led to the construction of the project were begun by the State of California during the early twenties and published in a State Water Plan report of 1927. That same year Congress directed the Engineers to make a physical and economic study of all the river resources of the State. Later, during the Depression, as the State endeavored to secure federal help for the basic Central Valley Plan (Project), Pine Flat was not included in the C.V.P. It will be remembered that, at the time, the emphasis was on exporting surplus water from the North, and the Sacramento River seemed the only likely source. Even so the State was still interested in the site.

The Sacramento District was asked to look into the project again under the terms of the 1936 Flood Control Act. Prior to that time, the Mississippi and Sacramento Rivers had received federal flood control monies. But, in 1936 halting the damage done by floods became a nationwide concern, on the premise that taken together floods constituted a cumulative drain on national resources. On the Sacramento, San Joaquin and their tributaries, it was estimated that the annual loss due to flooding amounted to about eight million dollars.

While the authorization, planning and construction of a major dam and reservoir is never a simple task, the confusion and embroilment surrounding the development of the Pine Flat project seemed, at times at least, more akin to a script for a soap opera than a serious essay. Not only were there longstanding questions of federal/state involvement, but before final authorization was given to the Corps of Engineers, the scene was littered with contradictions.

Based on the 1936 Act, the Sacramento District, through the O.C.E. and Secretary of War, submitted its report on the Kings River to Congress in February 1940, where it became House Doc. 630, 76th Congress. At about the same time, however, a feud was developing between the Departments of Agriculture and Interior over jurisdiction of national forests. When the smoke cleared, the Interior Department was on top of the heap — which soon led to its involvement with Pine Flat. Before long, Secretary of the Interior Ickes ordered the Bureau of Reclamation to make its own investigation for construction of a dam at Pine Flat. President Roosevelt, in the spring of 1940, wrote the Secretary of the Interior stating that the Bureau should build the dam, but not right away because of war in Europe and in Asia. Confusion reigned, for just a few months earlier FDR had marked "OK" on the report submitted by the Corps.

With the outbreak of war, most domestic programs were shelved — Pine Flat among them. But, once victory was assured, and with economists fearing tremendous numbers unemployed, Congress passed the Flood Control Act of 1944, which settled the question of who was going to build Pine Flat. Even so, things were muddled over the matter of repayment. As it worked out, both the Corps and the Bureau of Reclamation have played roles in this area. Operation and maintenance of the dam and reservoir are the responsibilities of the Corps. Local interests are required to pay for the conservation accomplishments of the project. They are also required to pay the annual operation, maintenance and replacement costs allocated to irrigation, and to provide all lands, easements, and rights-of-way for the downstream channel improvements. The Bureau of Reclamation executed interim contracts with users of irrigation water in 1963.

The dam, reservoir and downstream channel

GOVERNOR EARL WARREN (CENTER, HAND RAISED) DURING DEDICATION CEREMONIES AT PINE FLAT — 1947.

improvements form a unit of the comprehensive plan for flood control and related purposes for the entire Sacramento-San Joaquin Basin. Pine Flat Dam is a gravity-type concrete structure 429 feet high, 1,820 feet long and creates a reservoir of 1,000,000 acre-feet. The entire capacity is required for flood control, but, because of climatic conditions, full use of these same facilities are needed for conservation storage at the end of the flood season. Torrents that had earlier spelled ruin for those of the Kings River-Tulare Basin area now are regulated and released to nourish the rich fields of the southern San Joaquin, making it one of the richest farming regions in the world.

Construction was initiated on May 27, 1947, when Governor Earl Warren set off the first dynamite blast during dedication ceremonies. Colonel Dwight Johns, newly appointed Division Engineer, Colonel E. H. Marks, the retiring Division Engineer, and Colonel L. F. Rhodes, Sacramento District Engineer, were among the many dignitaries present at the function. In addition, largely through the efforts of the Fresno area boosters who wanted to make it a real celebration, thousands of spectators were on hand for the occasion. The blast that sent tons of rocks roaring down the canyon wall also signaled the end of the devastation because of the flooding of the Kings River. It was estimated that $15,000,000 in losses had been sustained from the waters of the Kings River alone from the time the flood control legislation of 1936 was passed to the beginning of construction in May 1947. Since completion in 1954, Pine Flat Dam has protected 80,000

GOVERNOR WARREN SET OFF THE FIRST BLAST TO MARK THE BEGINNING OF CONSTRUCTION OF PINE FLAT DAM — MAY 27, 1947
(Army Corps of Engineers Photo)

SHADY PICNIC SPOTS CAN BE INDIVIDUALLY YOURS AT SACRAMENTO DISTRICT, CORPS OF ENGINEERS, SITES ALONG THE SHORELINE OF PINE FLAT RESERVOIR NEAR FRESNO, CALIFORNIA.

(Army Corps of Engineers Photo)

acres of prime agricultural land in the Kings River region and, in conjunction with other Corps of Engineers dams, has effectively stopped the flooding of 260,000 acres of rich croplands in the Tulare Lake area. Additional channel improvements were begun in 1968 and have provided an added measure of safety and control of the released waters. During construction of the dam, penstocks and outlet provisions for future power development were built into the main structure, but to date power generating facilities have not been authorized.

For almost twenty years now Pine Flat Dam and Reservoir have served the residents of the Kings River region faithfully. Guarding against floods, providing water for irrigation and recreation, this quiet sentinel has saved lives and millions of dollars, and given pleasure to millions who use the lake for swimming, fishing, boating and picnicking.

ISABELLA

At 11:30 A.M. on May 29, 1948, the Kern River Post, Veterans of Foreign Wars, and the Kern River Veterans Club raised the American Flag just a few hundred feet from where Isabella Dam was to be constructed. The Kern County Union High School Band began to play, and Mr. E. C. Mill, principal of their school, felt a bit of pride swell in his chest as they did.

ISABELLA DAM BACKS UP A HUGE RESERVOIR OF WATER NEAR BAKERSFIELD, CALIFORNIA. THIS SACRAMENTO DISTRICT, CORPS OF ENGINEERS, DAM AND RESERVOIR OFFERS A VARIETY OF RECREATION ACTIVITIES SUCH AS BOATING, HUNTING, FISHING, SWIMMING, PICNICKING AND HIKING.
(Army Corps of Engineers Photo)

CONSTRUCTION OF THE OUTLET TUNNEL — ISABELLA DAM ON THE KERN RIVER — 1950.
(Army Corps of Engineers Photos)

Public ground breaking ceremonies for the soon to be constructed Isabella Dam were under way! After a lengthy list of local dignitaries was introduced, Colonel Joseph Gorlinski, Sacramento District Engineer, and Colonel Dwight Johns, Division Engineer, spoke of the benefits of the project. While reviewing the history and need for the dam, Colonel Johns told the following story:

> I heard the other day about a native Californian who was showing his Eastern cousin some of the wonders of this state. As they passed a magnificent citrus grove, the cousin said, "Just look at that — I have never seen such enormous grapefruits." "Oh, those," said the Californian, "are just one of our smaller varieties of lemons. The season's not very good." Farther along the road the cousin said, "And what are the gigantic blossoms over in that field? They are the biggest flowers I have ever seen." "Oh, that's just a patch of little dandelions," replied the Californian. By this time the cousin had picked up the cue, and when they crossed the bridge over the raging Kern River at flood stage, he said, "Ah, I see someone around here has a leaky radiator."

Colonel Johns went on to suggest that Californians knew that the Kern was no "leaky radiator." Indeed, the Kern River can at one moment lie calm, even docile, and hours later boil into one of the most violent streams in the West. Feeding as it does from the extreme southerly reaches of the Sierra Nevada, the Kern is itself a river of extremes. During dry years, the annual flow may be as slight as 185,000 acre-feet, but during a wet year the

A CONVOY OF DOZERS RAISE A LEVEE IN THE FLOODED TULARE LAKE BASIN TO PROTECT CROPS FROM BEING DESTROYED. THE BASIN RECEIVED BOTH RAINFLOOD AND SNOWMELT WATER FROM ONE OF THE WETTEST SEASONS IN HISTORY IN THE HIGH SIERRA NEVADA. APRIL 1969.

(Army Corps of Engineers Photos)

FLOODING THE CROPS SOMETIMES BECOMES NECESSARY TO PREVENT FURTHER DAMAGE. HERE A DIESEL POWERED PUMP TRANSFERS WATER FROM A DRAINAGE CANAL TO THOUSANDS OF ACRES OF DIKED LAND TO PREVENT UNCONTROLLED FLOODING. BY TAKING CALCULATED LOSSES THROUGH THE CONTROL OF FLOOD WATER, MILLIONS OF DOLLARS OF POSSIBLE CROP DAMAGE ARE SAVED. IT'S ALL PART OF THE FLOOD CONTROL SYSTEM OF THE TULARE LAKE AREA JUST NORTHWEST OF BAKERSFIELD, CALIFORNIA, WHICH RESPONDS TO THE OUTFLOW OF WATER FROM THE SACRAMENTO DISTRICT, CORPS OF ENGINEERS' FLOOD CONTROL DAMS ALONG THE SIERRA.
(Army Corps of Engineers Photo)

JOHN FREMONT AND FORTY-NINERS TRAMPED THROUGH THE RUGGED COUNTRY WHICH PRESENTLY CRADLES ISABELLA DAM AND RESERVOIR.
(Army Corps of Engineers Photo)

flow may increase tenfold to almost two million acre-feet of angry water. Before the dam was completed, floods occurred from sudden, unpredictable, and violent winter storms, and then later as a result of heavy unchecked spring runoff.

For almost twenty dry years (1917-1936), Kern County residents all but forgot the terrible danger of floods only to be jolted by six wet and costly years (1936-1943). Flash floods and high water lasting months took a fearful toll in Kern and Kings Counties. During 1943, some ten million dollars worth of damage was done to agriculture alone in the Tulare Lake Basin — the Kern River contributed almost half of the flow that caused the damage. Earlier the City of Bakersfield sustained extensive damage by being seventeen feet below the flood crest of the February 1937 flood.

For years residents of the southern San Joaquin Valley had advocated the building of works to harness the Kern, to make it serve, not destroy. The Corps and the State of California had studied the area for a number of years. Even before 1920, local interests and the State attempted to get a dam built, primarily for conservation purposes. A project predicated on conservatioon alone, however, never appeared to gain enough support to get funded. Need for development and control of the river was again recognized in Bulletin No. 29 published by the State in 1931. It wasn't until the Flood Control Act of 1936, though, that definite action was taken.

The Sacramento District, under the direction of Lt. Col. Chambers, District Engineer, and by the authority of the 1936 Act, undertook a study of the area in 1937. Their report was

completed in 1940 but not made public until 1944, due to the War. Their study disclosed that, on the average, almost three-quarters of a million dollars in flood control benefits would be realized with the completion of regulatory works on the Kern. Moreover, it was believed that an average benefit to irrigation and existing power facilities, to the tune of $185,000 would be realized. It wasn't long after the District filed its report that Congress authorized the Isabella Project in the 1944 Flood Control Act.

It was John Fremont, a Corps of Engineers officer, who named the river in honor of his party's topographer, Edward M. Kern. Forty-niners and survivors of many an ill-fated immigrant party crossing Death Valley also passed through the area. The gold rush to the northern mines had pretty well petered out when, in 1854, a fellow by the name of Richard Keys found pay dirt a couple of miles below the present dam. As others learned of the discovery, a tent-town named Hogeye sprang to life. Later the name was changed to Keysville. A few years later a prospector with the unlikely name of Lovely Rogers was about to heave a rock at his unruly mule when he took a second look at the object in his hand and was surprised to find he was holding a chunk of quartz laced with gold. It wasn't long before a conglomeration of tents and shacks became known as Quartzburg. Soon the city was captured by the army of Temperance, and the local saloonkeeper, a Mr. Hamilton, was escorted out of town. Resourceful guy that Hamilton was, he took most of his clientele with him and set up the town of Whiskey Flat, which adopted the more sedate name of Kernville in 1864. Things moved fast in Kernville in those days, and justice, partial as it was, kept pace. Once, when a well-liked fellow named Ollie Miles stabbed the village bully, a jury of Ollie's peers (and probably friends) ruled that the roughneck had committed suicide by throwing himself on Ollie's knife.

The dam and reservoir got their name from a much more famous person, Queen Isabella of Columbus fame. Actually it wasn't a direct connection, for a group of miners, neighbors to Hogeye and Whiskey Flat, started a little settlement and named it in her honor. At present all these settlements are resting quietly beneath the waters of Lake Isabella. Almost all of them, anyway. Most of Kernville was razed in 1948 when construction got underway, but some of its buildings were moved upstream to present-day Kernville.

Construction was initiated on March 16, 1948, under a contract with the Rand Construction Company. At the time of the formal ground-breaking ceremonies, some work had already been accomplished and was proceeding at a rate consistent with appropriations. Some five years later in April, 1953, the project was completed. Located about 50 highway miles (35 miles as the crow flies) northeast of Bakersfield, the project consists of a 185-foot high earthfill dam with an ungated concrete spillway in the left abutment. In addition, a 100-foot high earthfill auxiliary dam was needed to form a reservoir having a gross storage capacity of 570,000 acre-feet for flood control, irrigation and recreation. Federal cost was approximately twenty-two million dollars; it was money well spent.

Bakersfield and about 350,000 acres of farm land and oil fields in the Kern River region are protected by the project. As a partner to dams on the Kings, Kaweah and Tule Rivers, Isabella helps curb flood losses to cropland in the Tulare Lake Basin as well. During the floods of 1955, 1956 and 1958, the Dam and Reservoir prevented damages that would have amounted to two and a half million dollars. The facility paid for itself twice over during the record-breaking rainflood of December 1966, when operation of the project prevented more than fifty million dollars in damages. Just three years later, in January and February of 1969, the most damaging snowmelt floods of record occurred in the Tulare Lake basin. Coordination of Isabella dam and reservoir with the other flood control works in the area prevented a total of more than one hundred sixty-one million dollars in flood damage.

We'll never know how much suffering and loss of life was prevented, but it's reasonable to assume that the local residents had a few kind

THE OUTFLOW FROM ISABELLA DAM CONTINUED AT A HIGH RATE DURING APRIL 1969 TO LOWER THE RESERVOIR TO MEET THE RECORD SNOWPACK MELT.
(Army Corps of Engineers Photo)

FOLSOM DAM
(Army Corps of Engineers Photo)

words for the Sacramento District Engineers as they walked on dry floors in their stocking feet and listened to the rain pounding on the roof. And, during those hot, dry summers the farmers have an additional 50,000 acre-feet of water to pour over their parched fields.

FOLSOM

Few rivers in this country are as famous as the American (Rio De Los Americanos). Following Marshall's accidental discovery of gold on the South Fork of the American River, the area became the destination of thousands seeking quick riches. Men stood in freezing water, while their heads cooked in the blazing sun, searching the American for its treasure. At Rattlesnake Bar, Mississippi Bar, and other gravel bars in the river, thousands toiled; most never found much and turned to other enterprises. Some became exceedingly wealthy. Just a "good spit-in-the-wind" west of the present dam site, a group of black miners staked out a claim on a wide gravel bar in 1850. Nigger Bar (later renamed Negro Bar), as it became known, prospered for a while and then fell victim to the raging river next to which it was built. By then others had come to the area, and together, the survivors of the flood and the newcomers built a new camp on the bluffs overlooking the stream. Granite City, they called it. Early in 1855, Captain Joseph Folsom hired the now-famous Theodore Judah to survey the area and lay out a town, but before the lots could be marked and sold, Captain Folsom died on July 19, 1855, leaving to others the job of creating his town. After his death his heirs honored him by changing the name of the squalid settlement to Folsom City, and disposed of the lots by auction to land speculators and the squatters who had gathered there. Joe Folsom, considered by some to be not completely honest, acquired title to the land, Rancho Rio de los Americanos, through a long court battle, and by the application of questionable methods. The renowned historian, Bancroft, put it this way:

> It is necessary for the living to take charge of the effects of the dead, but it smells strongly of the cormorant the avidity with which men of prominence have participated sometimes in the name of friendship, but usually actuated by avarice. The body of William Alexander Leidsdorff was scarcely cold before Joseph L. Folsom obtained . . . an order to take charge of the estate . . .

Nonetheless, the town grew and prospered. Many a curious child spied the trains coming to the end of the line, and listened intently as the stage drivers, who met the trains at Folsom, called out their destinations: "Fiddletown, Volcano, Hangtown, Mormon Tavern, Shingle Springs, Buckeye Flat, El Dorado, Summit Hill and Diamond Springs." Just as intently, people listen today to the lyrics of country singer Johnny Cash as he bemoans the fate of those stuck in Folsom Prison, located a short distance from the present dam.

The first dam to be built on the American River near Folsom was completed in 1893. Intended to run the generators of the recently completed power house, it also created an irrigation project. And, it is not out of line to speculate that the small reservoir behind that dam cooled many a resident suffering through the valley's long hot summers. As long as a half century before this, however, men desired to harness the American. Before it was controlled it was as treacherous as any in the country. Often as not, when Sacramentans found themselves up to their armpits in frigid water, it was the American and not the Sacramento River that was responsible. Like a wild, incapacious beast bent on destruction, the unbridled American would roar down the Sierra, through the foothills, and onto the valley floor, sweeping everything and everybody in its path to ruination.

John Sutter wanted to control it for use as a waterway for logs. Early miners sought to dam the river to employ the waters to wash their gravel. In 1850, the Virginia Company constructed a dam and canal to clear the river bed for mining and to furnish a supply to their "Long Tom" sluice boxes. The Natoma Company dug a canal near Salmon Falls to bring water to Folsom and to provide water for the

OLD BRIDGE ACROSS THE AMERICAN RIVER NEAR THE SITE OF FOLSOM DAM.
(Army Corps of Engineers Photo)

INSPECTING FOLSOM DAM SITE — 1948. LEFT TO RIGHT — JAMES L. ROSE, RESIDENT ENGINEER; COLONEL DWIGHT F. JOHN, SOUTH PACIFIC DIVISION ENGINEER; COLONEL JOSEPH S. GORLINSKI, SACRAMENTO DISTRICT ENGINEER.
(Army Corps of Engineers Photo)

FOLSOM DAM PROJECT NEAR FOLSOM, CALIFORNIA. VIEW OF DIVERSION TUNNEL LOOKING DOWNSTREAM FROM STA. 6+55 ON RIGHT ABUTMENT OF MAIN DAM.
(Army Corps of Engineers Photo)


1ST BUCKET
of CONCRETE
FOLSOM DAM
OCT. 29, 1952

mines. H. G. Livermore wanted to build a dam at Folsom to create a mill pond for a saw mill operation. In 1868 he started a dam at Story Bar. Construction was stopped in 1882, then later finished by convict labor.

The Corps of Engineers has been involved with the American River since the late 1800s. First it was hydraulic mining debris, and later flood control that concentrated their attention on the stream. A great deal of data was gathered when the Sacramento District worked on the "308" studies. Additional information was called for and gained because of the Flood Control Act of 1936. It was at this time the "benefit-cost ratio" formula was initiated. All agreed that a dam was needed at the confluence of the North and South Forks of the American River; the size and capacity of the dam and reservoir, on the other hand, were a source of heated arguments. The State of California, in a report to the Legislature in 1931, recommended utilizing the natural site near Folsom for a reservoir with a capacity of 355,000 acre-feet.

The Sacramento District Engineers, too, in their earlier studies, had determined that a reservoir of about this size would be adequate. These plans were drawn up during the Depression, and they represented the restricted thinking of that era. After studying the situation further, the Corps modified its thinking and came to believe that a much more substantial structure would be needed to do the job. To complicate the matter further, the Bureau of Reclamation looked at the American River in terms of the overall development of their Central Valley Project. As it did for other projects, the massive 1944 Flood Control Act determined who was going to build the project, but left other questions (irrigation, power development, etc.) unanswered. For a time, in fact, the 1944 bill made no mention of American River development, but was added at the urging of Senator Downey.

Originally, the authorization was for the smaller project put forth by the state. Finally, after much discussion, Governor Earl Warren stated that if the federal government wanted to pay for a dam three times larger than the one originally planned, the state shouldn't object. The Sacramento District engineers drew up plans for a reservoir with a 1,000,000 acre-foot capacity. Congressman Clair Engle pressed for the larger project, and when President Truman sent a special message to Congress specifically recommending expansion of the American River, the Corps-size project was all but assured. Meeting in Sacramento, Colonel Joseph Gorlinski, Sacramento District Engineer, Edward Hyatt, of the State Water Resources Board, Governor Warren and representatives of the Bureau of Reclamation worked out what became known as the "Folsom Formula."

So that construction could begin without further delay, a million dollar appropriation was secured with the understanding that additional legislation would be forthcoming to enlarge the project and to incorporate the agreements reached as part of "Folsom Formula." Hearings were held during the spring of 1948, but the Eightieth Congress failed to act. The next year, enactment of Public Law 356 of the Eighty-first Congress, signed by President Truman on October 14, 1949, settled the matter once and for all. As amended, the legislation provided for: (Folsom Formula)

1. A 1,000,000 acre-foot reservoir and dam to be built by the Corps of Engineers.

2. A hydroelectric plant at Folsom Dam to be constructed by the Bureau of Reclamation.

3. A downstream dam and power plant (Nimbus) and all necessary transmission lines from these power plants to load centers to be constructed by the Bureau of Reclamation.

4. Folsom Dam and Reservoir to be transferred to the Bureau of Reclamation for operation and maintenance in accordance with the federal reclamation laws and Section 7 of the Flood Control Act of 1944.

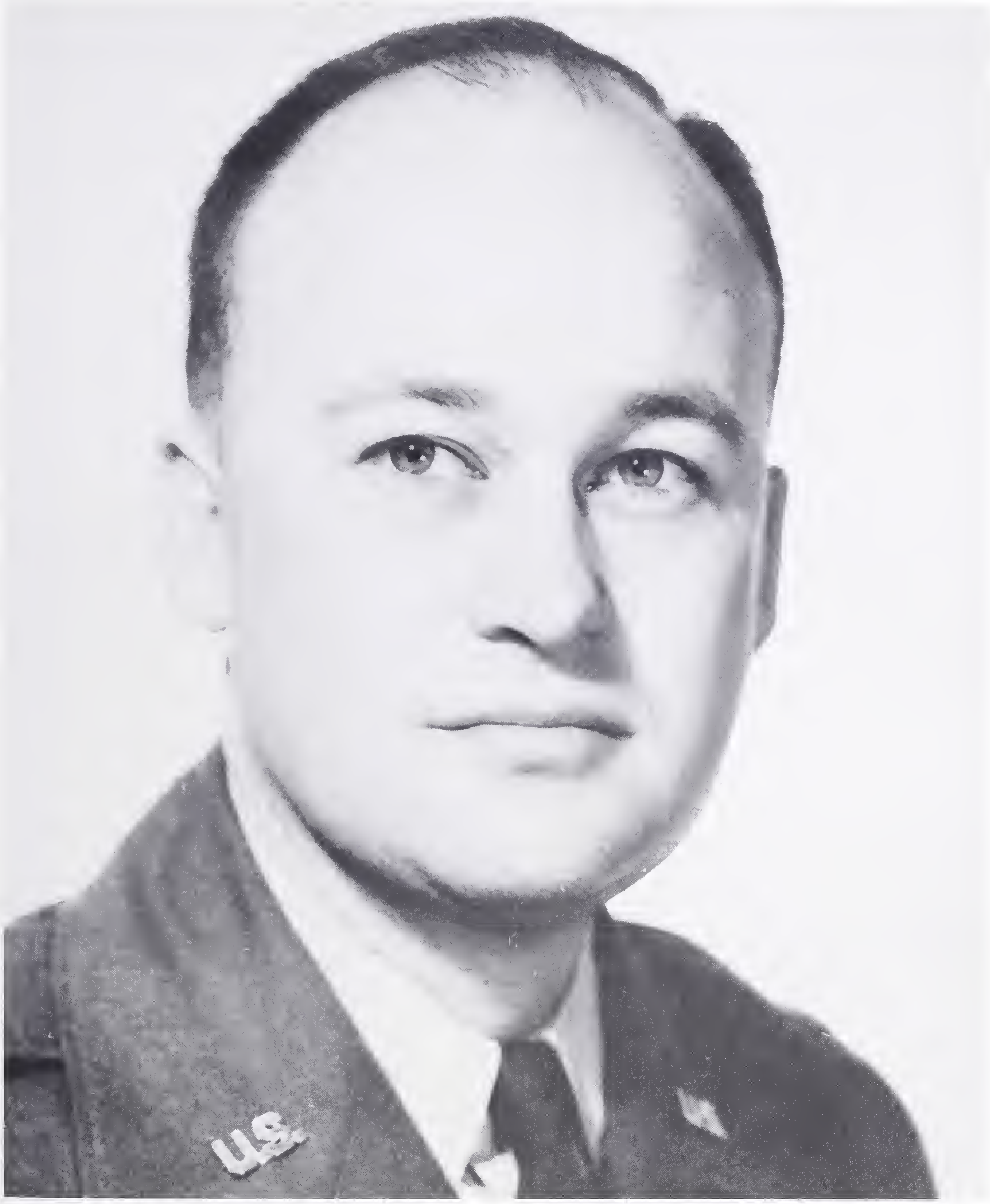
5. Folsom Dam and Reservoir to become an integral part of the Central Valley Project.

FOLSOM DAM SITE FOUNDATION EXCAVATION WORK.

BY JANUARY 1954 THE HALF-WAY POINT HAD BEEN REACHED IN THE PLACING OF CONCRETE. DISTRICT PERSONNEL POSE FOR THE OCCASION.

BY THE SPRING OF 1954 FOLSOM DAM WAS WELL ON THE WAY TO COMPLETION.
(Army Corps of Engineers Photo)

DURING DECEMBER 1955, FOLSOM DAM PREVENTED MILLIONS OF DOLLARS IN DAMAGES TO THE CITY OF SACRAMENTO AND THE SURROUNDING AREA.



COLONEL ALVIN D. WILDER — SACRAMENTO DISTRICT ENGINEER, DECEMBER 1955 — JULY 1956.

ELMO A. BRULE
SACRAMENTO DISTRICT, 1911-1954

Born 29 February 1884 near Modesto, California. LLB, San Francisco Law School, 1915. Admitted to the State of California Bar in 1915. Entered federal civil service in 1904 through appointment in the Post Office Department, Alameda, California, later served at Mare Island under the Navy Department. Was appointed Clerk in the Second San Francisco District, transferred to the Third San Francisco District and California Debris Commission July 1920, and promoted to Chief Clerk. This was the senior administrative slot of the district and he had direct charge, immediately under the District Engineer, of all disbursing, finance and property accounting and of general district office administration. He stayed in that position when the district office was moved to Sacramento in 1929. He served as Chief Clerk, Chief Administrative Assistant, Administrative Officer, and Executive Assistant until the time of his retirement in March, 1954. He was on loan to the Los Angeles Engineer District for 13 months during 1935-36 as Chief Administrative Assistant to aid in the reorganization and expansion when that district initiated work on the flood control project for Los Angeles County. He served continuously in the US civil service from his original appointment until he reached mandatory retirement age, missing a half century of service by thirty-eight days. Elmo Brule died in July 1966 at the age of 82.

On March 7, 1956, Army Engineers of the Sacramento District, in a quiet ceremony, hoisted the national colors above the dam to signal completion of the project. Formal dedication ceremonies were held on Saturday, May 5, 1956. Everybody who was anybody was there; Governor Knight; Assistant Secretary of the Army Roderick; Congressmen Moss, Kuchel, Engle, and Murray; and a host of others. The Sacramento District turned out en masse for the event; after all, they had worked for over seven years on the construction phase of the project, to say nothing of the many years of planning.

The main dam has a concrete gravity river section with earthfill wing dams. It is 340 feet high and 10,200 feet long. An auxiliary dam at Mormon Island is an earthfill structure 110 feet high and has a crest length of almost 5,000 feet. Eight earthfill dikes were also built to help form the reservoir. They range in height from ten to one hundred five feet, and together have a total crest length of 11,710 feet. If added together, the main dam, the auxiliary dam and the dikes would form a solid barrier almost three miles long.

Folsom is truly a multipurpose structure. Constructed primarily for flood control, it also provides hundreds of thousands of acre-feet of water for irrigation, power development, wildlife conservation and recreation. The lake covers parts of three counties and has been highly developed by the California Division of Beaches and Parks.

Folsom Dam is one of the greatest projects of its kind in the West. After engineers from the Sacramento District laid several test strips they determined the best method of compaction of some 13,000,000 cubic yards of fill. Construction began in October of 1948 on the extreme right wing of the main dam, and by August of the following year excavation was well underway. It was then that the engineers experienced their first real difficulty. A previously unknown fault was found under the left abutment, which required extensive excavation. A real milestone was reached with the pouring of the first bucket of concrete on October 29, 1952. From then on, the four-cubic-yard buckets operated on an around-the-clock schedule. When finished, 1,050,000 yards of concrete had been placed.

Meanwhile, construction of the power plant and the eight dikes, some of which qualify as large dams themselves, was proceeding on schedule. Not that the American was going to be civilized without a fight, for on several occasions, the swollen river reacted violently, washing out the cofferdams. On February 25, 1955, a 52-ton steel gate was dropped into place and effectively closed the 1,500-foot diversion tunnel, causing the lake to begin filling. As the giant slab slipped into place, a

ELMO BRULE

small group of men warmed themselves over a small fire on a bluff a hundred feet above the tunnel opening. Among those keeping the vigil were Lt. Colonels Grace and Wilder of the Sacramento District Office; Colonel William Ely, District Engineer; Donald Horton, Assistant Secretary of the Army; Horace Johnson, Chief of Construction-Operations Division of the District, and Mr. O. Haven Hart, who was his assistant at the time. Most of the engineers who had worked on the project from the start were there also. Backs to the wind, they experienced the warm glow of satisfaction that comes from knowing you've done a good job.

It wasn't long before the great barrier would receive its first crucial test. During the great flood of December 1955, the greatest river flow to that time filled the yet-to-be-completed reservoir in a matter of days. By being able to control the river for the first time, the dam saved the City of Sacramento from disaster and prevented $20,000,000 in damages to highly developed agricultural land. During the February, 1963, flood, the project prevented approximately forty-five million dollars in damages. It was estimated that a like amount was saved the next year during the December, 1964, floods. Hence, in only a few years, the dam more than repaid the $63,000,000 it cost to build. Again, no way has yet been devised to accurately estimate the amount of human suffering that was prevented. Surely it was, and will be, considerable. From its stormy baptism to the present day, this unique structure has all but eliminated the danger of flooding on the American.

Like many other man-made reservoirs in the West, Folsom Lake, of necessity, covered old ghost towns as it filled. Probably no one will ever know just how many, but at least two dozen were known to have existed in the area. The area of El Dorado County covered by the lake had the majority, including Growler Flat, Condemned Bar, Wild Goose Flat, Rattlesnake Bar, Salmon Falls, Quail Flat, Manhattan Bar, Granite Bar, Long Bar, McDowell Hill, Higgins Point, Jenny Lind Flat, Buckeye Flat and Elephant Flat. Where the lake covers Sac-

OFFICE SERVICE BRANCH INTER-DISTRICT CONFERENCE — NOVEMBER 1957
(Army Corps of Engineers Photo)

ramento and Placer Counties were places such as Mormon Island, Red Bank, Poker Bar, Bean, Maple Ridge, Doton Bar, Carlton and Horseshoe Bar.

Earlier the Army Engineers from the Sacramento District and other agencies, including the Smithsonian Institution, combed the area in search of Indian artifacts. While their finds were not spectacular, they did add to the knowledge of the Indian tribes of the area, both in historic and prehistoric times. Another delicate job performed by the Sacramento District was the transfer and relocation of last remains from graveyards. Hundreds of people were interviewed as to how many bodies were buried in the area to be flooded. Many graves were unmarked and some almost impossible to recognize. It was known that eighteen persons were buried near Salmon Falls, and it was thought that 36 graves were located at Growler Flat. The greatest number were at Mormon Island; from Dr. McCall who died in 1850 at the age of 26, to Kate Edmonds who passed away at the age of 93, on June 12, 1950. In carrying out this task, as with all the other jobs completed by the Sacramento District in building Folsom Dam, the work was done in a professional manner and with the respect due the early pioneers. The relocated cemetery is now situated just south of the Mormon Island dike.

MERCED COUNTY STREAM GROUP

The 1944 Flood Control Act was the most important document of its kind in American history. It is probable that never again will so many vital civil works projects be authorized at one time. And while it is true that the majority of the flood control dams planned and built by the Sacramento District were large, imposing works, other smaller projects, just as important to the residents of the area, were begun while Pine Flat, Isabella and Folsom Dams were being completed. Examples of this type of work are the dams and reservoirs of the Merced County Stream Group.

A few miles east of the city of Merced, a maze of creeks and sloughs tumble through the foothills of the central Sierra. Most of the year they lend themselves to quiet picnics, lazy walks through fields of California poppies brought to life by spring rains, or brisk autumn hikes on trails that wind through groves of oaks. But, like their larger cousins, these placid streams can gorge themselves on torrential rains, rush out of hills on a wave of destruction, and flatten or carry away that which stood in their way. Does it really matter whether one is drowned by a small stream or a large river?

To bring these unruly waterways under control, the Sacramento District has constructed four dams and reservoirs which protect about 136,000 acres of agricultural land while adding a large measure of security to the people living in Merced, Planada and LeGrand. As with so many other projects, the dams were planned during the Depression but had to wait out the war before being started. The largest of the four reservoirs, Mariposa, was begun in March, 1948, and finished by November of the same year. Located on a creek of the same name, the dam is an earthfill structure 88 feet high, almost 400 feet thick at the base, and over 1,300 feet long. It has an ungated saddle spillway, a pair of auxiliary dikes, and backs up Mariposa Creek (also known as Duck Slough) to form a reservoir of 15,000 acre-feet.

Owens Dam, completed in October, 1949, was the next component of the project to be finished. Similar in design to the others in that it, like they, are earthfill structures having ugated saddle spillways, it is located about two miles north of Mariposa Dam. The smallest reservoir of the four, it stores only 3,600 acre-feet of water. Owens Dam is 75 feet high and 790 feet long.

The fifty-three foot high Burns Dam was completed just six months before the outbreak of the Korean war. Together with an auxiliary dike, it forms a reservoir on Burns Creek with a capacity of 6,800 acre-feet. Even though it's the lowest structure of the group, it has the distinction of being longer, at 4,074 feet, than the other three dams combined.

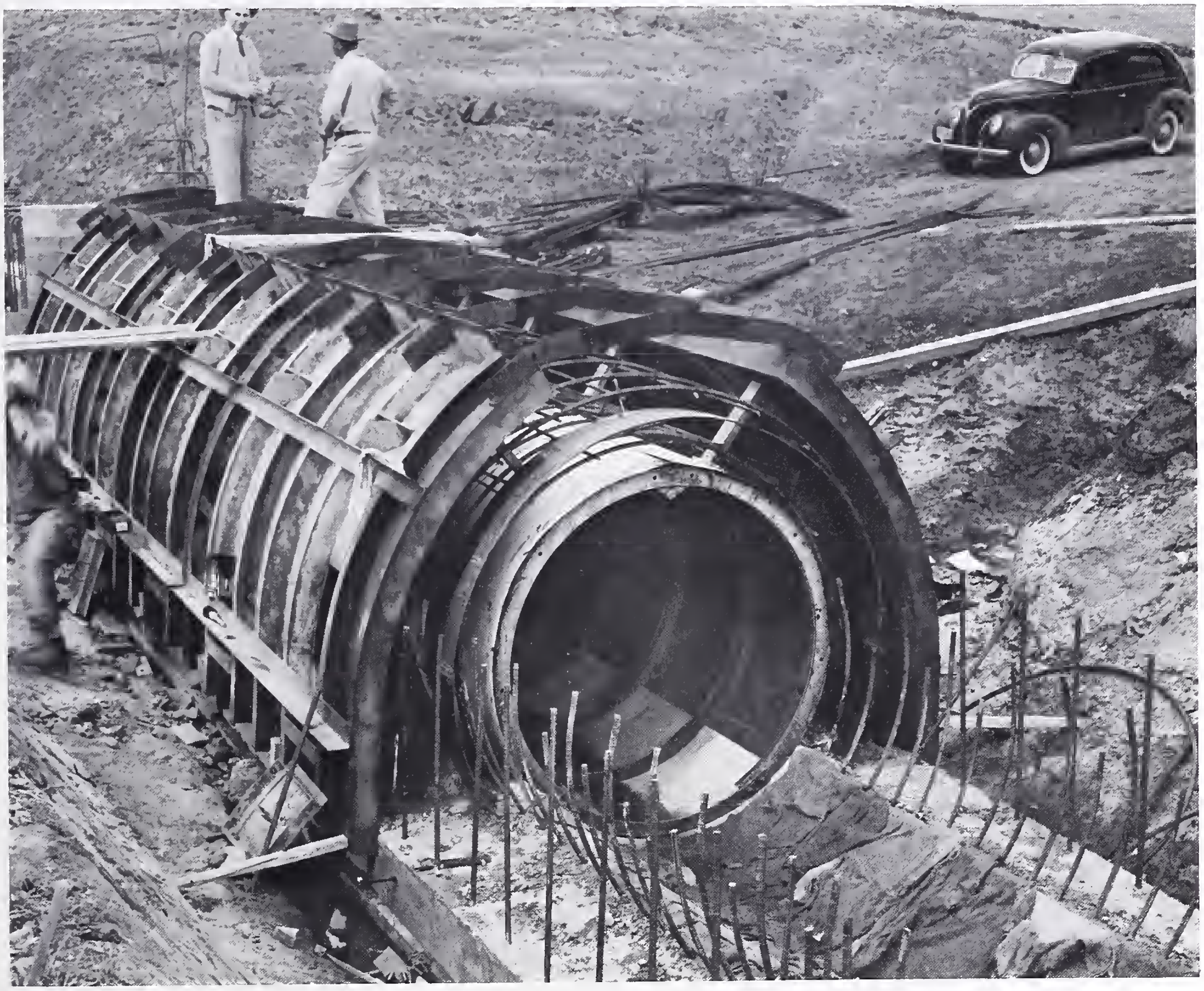
Four years later, in December, 1954, Bear Dam and Reservoir, on Bear Creek, was completed. The last to be finished, it is the highest, 92 feet, and the second longest, 1,830 feet. Its

MARIPOSA DAM
(Army Corps of Engineers Photo)

reservoir of 7,700 acre-feet is just slightly larger than that behind Burns Dam.

The project was constructed for the sole purpose of flood control, and it didn't have long to wait before receiving a severe test of its capabilities. During the December 1955-January 1956 floods, these four small dams held the streams in check and prevented an estimated $4,800,000 in damages to towns, farms and transportation facilities of the Central San Joaquin Valley. Moreover, by reducing the maximum flood flows of the San Joaquin River, the danger to Stockton and the Delta region was lessened. Again, during the 1958 flood, damages estimated at more than five and a half million dollars were prevented. By that time, however, the Sacramento District had completed two diversion canals downstream from the dams to help distribute the water. Black Rascal Creek flows can now be carried in part by Bear Creek, and excess water from Owens Creek can pass to Mariposa Creek through a 400 second-foot capacity canal.

Local interests were required to furnish lands, easements and rights-of-way, as well as being responsible for highway and utility modifications. Total costs for all requirements of local cooperation were $1,148,000. The project as a whole was finished in Fiscal Year 1957 at a cost of $2,751,259 to the federal government. Besides being important to the immediate area



OUTLET WORKS — MARIPOSA DAM.

FARMINGTON DAM PROJECT NEAR FARMINGTON, CALIFORNIA. COMPLETION PHOTO — VIEW LOOKING SOUTHERLY FROM RIGHT ABUTMENT SHOWING RIP-RAPPING FOR SLOPE PROTECTION.
(Army Corps of Engineers Photo)

FARMINGTON DAM AND RESERVOIR.
(Army Corps of Engineers Photo)

it serves, the project forms an essential link in the overall flood control plan for the San Joaquin Valley. Operation and maintenance are the responsibility of the Sacramento District, Corps of Engineers.

FARMINGTON DAM

A few miles south of Stockton on U. S. Highway 50 is the settlement of French Camp. This tiny village hugs the south bank of Littlejohn Creek. In the old days, prospectors used to follow the stream on their way from Tuleburg (Stockton) to the mines. Like the rest of the streams of the Western Sierra Nevada, Littlejohn Creek frequently spilled over its banks, and when it did it put the settlements along its banks under water. Furthermore, its uncontrolled floods met the San Joaquin River just south of Stockton, adding the straw that often broke the levee's back.

To correct the situation, the Sacramento District constructed Farmington Dam and Reservoir three and a half miles upstream from the town of Farmington. Work on the project was started in the summer of 1949, and by June, 1951, the main dam and spillway were completed. Additional downstream improvements on Duck Creek and Littlejohn Creek were finished by the spring of 1955. Later, Congress authorized the enlargement of Duck Creek channel downstream of the diversion structure, which had been completed in May, 1955. The enlargement work was finished in January, 1967. Together, these improvements, built strictly for flood control, afforded protection to 58,000 acres of farm land, suburban and industrial areas immediately southeast of the City of Stockton. Local interests were required and have provided, without cost, all necessary lands, easements and rights-of-way for the diversion channel, and have modified all bridges and utilities to conform to the needs of the project.

The dam itself is a long, low earthfill barrier 58 feet high and 7,800 feet long (crest length) that forms a reservoir with a capacity of 52,000 acre-feet. Federal construction costs of $3,676,384 were more than justified, in that by preventing flood damages during 1955-56 and 1958, the dam, reservoir and appurtenant facilities spared residents of the area a lot of grief, and saved an estimated five and a half million dollars. Local interests are responsible for the operation and maintenance of the channel improvements, while the Corps maintains and operates the dam and reservoir.

SUCCESS AND TERMINUS

During dedication ceremonies for Pine Flat Dam in 1954, the Chief of Engineers stated that flood protection facilities of the southern San Joaquin Valley "still had a hole" in them. His comments alluded, of course, to Kaweah and Tule Rivers, at the time flanked by the recently completed Isabella and Pine Flat Dams on the Kings and Kern Rivers. These four rivers form one complex drainage system that, until checked, emptied into the Tulare Lake Basin and only partially into the San Joaquin River. Each begins within a few miles of the others near Mount Whitney, pursues a separate and turbulent channel down the face of the western Sierra, smacks the floor of the San Joaquin Valley with sizable impact, then combines to nourish or flood the Tulare Lake Basin. With the ground breaking ceremonies for Success Dam near Porterville on the Tule River on 16 October 1958, Sacramento District engineers began to "plug the hole" in the system. And, when construction got underway only a few months later on Terminus Dam, the residents of the Kaweah-Tule River Basin felt sure that soon they would no longer have to fear their benefactors, the Tule and Kaweah Rivers, but simply appreciate them.

For years the southern San Joaquin Valley, when compared to the Sacramento with its magnificent flood control works, remained virtually defenseless against both flood and drought. From 1938 to 1958, major floods visited the area to spread their ruin. Prior to 1938, many waterless years caused a great deal of harm, only in reverse. But, when the Sacramento Engineers completed Success in the spring of 1961, and Terminus during the summer of the following year, they captured that pair of mindless vandals, flood and drought, and rehabilitated them so that they

TERMINUS DAM AND LAKE KAWEAH
(Army Corps of Engineers Photo)

HEAVY MIST RISES FROM THE OUTFLOW OF TERMINUS DAM ON THE KAWEAH RIVER ABOVE VISALIA, CALIFORNIA. THIS FLOOD CONTROL DAM IS OPERATED AND MAINTAINED BY THE SACRAMENTO DISTRICT, CORPS OF ENGINEERS, AND IS A MAJOR CONTRIBUTOR IN KEEPING AGRICULTURE OF THE VALLEY HIGHLY PRODUCTIVE.
(Army Corps of Engineers Photo)

PLACING CONCRETE-FILLED SANDBAGS ACROSS THE LIP OF THE TERMINUS DAM SPILLWAY, THE SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS, GAINED ABOUT 10,000 ACRE-FEET OF ADDITIONAL STORAGE SPACE DURING THE RECORD SNOWPACK SNOWMELT OF JUNE 1969.
(Army Corps of Engineers Photo)

could provide succor instead of destruction. Moreover, we learned earlier, especially in the case of the Folsom Dam and Reservoir, that substantial works are not the products of a single night's dream, nor do they affect only the land on which they are constructed. Each is the end result of years of toil and sweat by many, meant to satisfy a variety of needs. A project always has ramifications extending beyond its immediate time and perimeters.

The lake beds of Success and Terminus, and the hills that enclose them, are as rich in history as any in the state. It was in 1856 that Sardis Wilcox made a home for himself and his family on a quarter section at the junction of the main and south forks of the Tule River. Until realtors of the Sacramento District purchased the land, members of the Wilcox family held title to the original parcel as well as adjacent tracts within the region. In fact, it was John A. Wilcox who detonated the initial dynamite charge that signaled the start of construction on the Success project. Hidden beneath the quiet water of the reservoir are the old adobe home of Origen Wilcox, the orange trees planted by Herman Templeton before the turn of the century, and the site of the Wilcox family cemetery, which has since been relocated.

H. H. Holy of Visalia, a long time resident of the Kaweah River region, set off the blast that began the work on Terminus Dam. As he did, the echo brought a smile of achievement to many; the cherished dreams of decades were being fulfilled. For others who had spent their lifetimes on the property of their parents and grandparents, it was grief and disappointment that gripped their hearts. Swallowed up by the waters behind Terminus Dam are homesteads, first settled in the summer of 1856. Hale Thorp, the first white settler to come to the area, brought his family to the banks of the Kaweah River that year and made a home for them. His grandson, Dave Mehrten, whose place joined the old homestead on the south, was one of the last to move out of the reach of the rising water. Some of the first to go were the descendents of Charles Marx and J. W. B. Rice, whose homes were built very close to the damsite. Mr. Marx settled the area in 1884 and planted one of the first orange groves in the district. The dams, which give protection and sustenance to the many, have had to sacrifice the possessions of the few.

The first to suffer the encroachment of western civilization in the area were the Indians. As early as 1804, Spanish expeditions attacked and destroyed Indian villages. In their zeal to convert the territory to Christianity, the Spaniards captured many Indians, especially children, and took them to the coastal missions. An exception was the Monochi Indian group of the upper Kaweah River region who remained unmolested, save for possible epidemics of which there are no records. By the middle of the nineteenth century, however, native civilization along the lower reaches of Tule and Kaweah Rivers was seriously disorganized. While Indian contact with Europeans was rare in the higher reaches, it was violent and catastrophic in the area where the rivers meet the valley floor. In general, the Indians didn't suffer to a great extent because of the gold rush, simply because relatively few miners came to the region. The history of the Tule and Kaweah Rivers is and has been measured by bushel baskets of wheat, vegetables and fruits, not ounces of gold dust. Hence, it was early recognized that the control of these streams was essential if the full potential of the land was to be realized.

The first Corps of Engineers officer to visit the area was John C. Fremont. During his second expedition he crossed the Sierra in the dead of winter, rested briefly at Sutter's Fort, and then made his way south through the San Joaquin Valley during the spring. On April 9, 1844, he camped on the banks of the Kaweah. In his journal, he referred to the Wukchumni Indians, who lived in the vicinity, as the "Horse-thief Indians." Six years later, in 1850, Corps of Engineer officer Lieutenant George H. Derby was sent into the Tulare Lake Basin to find a suitable place for the establishment of a fort to protect the San Luis Obispo area from Indian raids. In describing the delta of the Kaweah River, Lt. Derby wrote:

The land is excellent for cultivation, well

QUIET WATERS AND MOUNTAIN SCENERY BECKON THE NATURE LOVER AT LAKE KAWEAH CREATED BY TERMINUS DAM, A SACRAMENTO DISTRICT, CORPS OF ENGINEERS, EARTHFILL STRUCTURE ON THE KAWEAH RIVER, SOME 20 MILES ABOVE VISALIA, CALIFORNIA.
(Army Corps of Engineers Photo)

> timbered and an abundance of excellent building material may be found close at hand . . . it is a beautiful, smooth, level plain covered with clover of many different kinds and high grass and shaded by one continuous growth of oaks of a larger and finer variety than I have ever seen in the country.

The land, which now lies at the bottom of Lake Kaweah, gradually developed into an agricultural region devoted to dry and irrigated farming, citrus groves and livestock ranching. The small town of Terminus served the needs of the local ranchers and orchardists. From a deposit at Lime Kiln Hill, presently the south abutment of Terminus Dam, limestone was mined and utilized throughout the valley for some seventy years prior to the construction of the dam.

The Corps of Engineers again was involved in the area when conducting the "308" studies, and while completing its investigations relative to the 1936 Flood Control Act. Held up by the war, authorization for the two projects was finally included as a part of the Flood Control Act of 1944. Even though some preliminary work was accomplished, interest in the work began to lag. Tulare County had suffered the ravages of major floods in 1862, 1866, 1875, 1879 and 1906 besides the several that occurred during the late thirties and middle forties. At other times, crops shriveled and cattle dropped and rotted under the searing heat of drought. It required the massive Christmas flood of 1955 to arouse the populace to renewed action. They soon learned that, by delaying the work for years, the original authorization of $4,600,000 was far from enough to complete the projects.

Wading through turbid water, often up to their necks, Visalia and Porterville residents and valley farmers surveyed their damages, looked at the absence of flood damages on the Kings and Kern Rivers, cursed themselves and the rivers, and realized that in just this one flood they had lost more than it would have cost to build both dams.

On January 17, 1956, representatives of cities, irrigation districts, boards of supervisors, and other groups packed the office of the Kaweah Delta Water Conservation District in Visalia and decided to act. They formed the Terminus-Success Flood Control Dams Association, and elected Jack Chrisman to be permanent chairman. Then they took immediate steps to place the projects on the Army Corps of Engineers "most wanted list." With the aid of their representatives in Washington, they were able to get the projects included in the Omnibus Bill of 1956, only to have the bill vetoed. The next year Congress passed another similar bill, but it too was vetoed because President Eisenhower felt it was loaded with unnecessary projects. Finally, the 85th Congress, in the summer of 1958, passed a revised bill that was signed by the President on July 3, 1958, which carried an authorization of 28 million dollars for Success and Terminus Dams.

Sacramento District engineers began exploratory drilling of Lime Kiln Hill and Bells Bluff, the south and north abutments of Terminus Dam, found the site satisfactory, and completed plans for the project. Like operations were also underway at the Success Dam site. Here on October 16, 1958, ground breaking ceremonies were held for Success Dam and Reservoir. Brig. Gen. R. G. MacDonnell, South Pacific Division Engineer, delivered the principal address, in which he emphasized the fact that "the hole" in flood protection works was about to be plugged. A few months later, Colonel A. E. McCollam, Sacramento District Engineer, served as the main speaker at the ground breaking for the Terminus project held on Thursday, 19 February 1959.

Success, named for a small mining town nearby, was the first started and first finished. Located about six miles east of Porterville, the $14,250,000 earthfill dam backs up a reservoir of 85,000 acre-feet. This vital unit of the comprehensive Sacramento-San Joaquin Basin flood control plan consists of a main dam 142 feet in height and an auxiliary earthfill dam about 40 feet high. The main dam has an ungated saddle spillway (broad-crested weir) with a crest length of 200 feet and a capacity of 126,000 c.f.s. The primary work of the project is, of course, to protect the lives and property of

FLOODED FARM BUILDINGS IN THE TULARE BASIN RESULT FROM THE RECORD SNOWPACK IN THE HIGH SIERRA NEVADA FOLLOWING THE RAINFLOODS OF FEBRUARY 1969.

(Army Corps of Engineers Photo)

SITE OF SUCCESS DAM PRIOR TO CONSTRUCTION (TAKEN IN FEBRUARY 1959). THIS DAM IS ON THE TULE RIVER, IN TULARE COUNTY.

those living below the dam, and to prevent the flooding of 60,000 acres of rich farmland. By-products of this function are the additional water for irrigation and a substantial pool for recreation and wildlife conservation. The project almost paid for itself during the record-breaking rainflood of December, 1966, when it prevented an estimated $10,000,000 in damages along the Tule River and an additional $400,000 in losses to the Tulare Lake Basin.

Twenty miles east of Visalia stands the 250-foot high Terminus Dam. Here, too, an auxiliary dam was needed to create the reservoir. When at capacity, the facility stores 150,000 acre-feet of water for flood control, irrigation and recreation. The $19,300,000 barrier more than paid for itself in the December 1966 flood. Moreover, the men, women and children of Visalia and some 126,000 fertile acres of croplands are protected by the silent and obedient sentinel straddling the Kaweah River.

In recalling the events that led to the construction of Pine Flat, Isabella, Success and Terminus Dams, mention has often been made of the Tulare Lake Basin. Perhaps a brief word of description would help explain this body of water that no longer exists, and further demonstrate the significance of the four Corps of Engineers dams located in the southern San Joaquin Valley. A mere century ago, Tulare was the largest lake west of the Rocky Mountains. Fed by the Kern, Tule, Kaweah and Kings Rivers, this great shallow inland sea was home to a variety of aquatic life; salmon, perch and sturgeon once supported a commercial fishing industry. Yokut Indians lived along the shores and on the islands of this lake, that covered some 800 square miles of the upper San Joaquin Valley, as late as 1862. The "Mose Andross", a schooner, was built for the express purpose of hauling cattle and hogs across Tulare Lake. In 1876, it was converted to a sidewheel steamer with parts salvaged from a steamboat that had tried to reach the lake in 1862 by pushing up the San Joaquin River. Running aground just short of its mark, it rested for years in the mud until it was broken up in the conversion of the "Mose Andross." Years later, the "Water Witch" joined the fleet of shallow draft vessels on the lake and was used to catch terrapin, served as delicacies in the finer restaurants of San Francisco.

Over the years, the lake would wax and wane, in proportion to the variations in rainfall. On a half dozen occasions, since records have been kept, the lake has dried up altogether. Usually, though, it would recede gradually, exposing rich alluvial soil that tempted farmers to plant their crops along its edges. During the latter years of the 19th century, a series of dry years and increased irrigation shrank the lake to almost nothingness. Then, in 1880, the California legislature passed a law allowing farmers to purchase reclaimable swampland for only $2.50 an acre, most of which would be refunded to the buyer if he spent a like sum on levees and other reclamation projects. Enactment of this law caused a stampede to the area, and the reclamation and irrigation districts that were formed were soon hard at work draining the marshlands, building leeves and cultivating fields where not long before Indians fished from tule-reed rafts. "Sandlappers," as they were called by the cattlemen, fitted their horses' hooves with boards so they wouldn't sink in the muck as they worked to push the lake back and reclaim more land.

More than once, competition for the rich lakebed exceeded the limits of legal and gentlemanly behavior in an eruption of heated argument and gunfire. What began as a quiet May morning in 1880 ended as the "Battle of Mussel Slough." It was here, near Hanford, that seven men were killed in a dispute that was caused by the Southern Pacific Railroad playing fast and loose with the settlers and land speculators over the ownership of a certain parcel of reclaimed swamp. The tragic incident gained nationwide fame in Josiah Royce's, "The Battle of Oakdale Flat," and Frank Norris' novel, "The Octopus." In time, literally the entire lakebed was transformed into some of the richest agricultural land in the world. But, unprotected by effective control works, the phantom lake would return with the torrential rains that occur in the southern

SUCCESS DAM — NEARLY COMPLETE: NOTE THE CONTROL TOWER ON THE LEFT.
(Army Corps of Engineers Photo)

THE DAMS THAT PROTECT THE TULARE BASIN ALSO PROVIDE PRECIOUS IRRIGATION WATER FOR THOUSANDS OF ACRES OF RICH FARMLAND.
(Army Corps of Engineers Photo)

Sierra. And when this happened, it took years to dry out the land and rebuild the irrigation and flood control works.

The four dams built by the Sacramento District in the area have changed the situation considerably. Working together as an integrated system, they prevent flood damages to 260,000 acres of cropland in the Tulare Lake Basin. Over the years, they have prevented, and will continue to prevent, the loss of life, suffering, and tens of millions of dollars worth of damage to the "Phantom Lake" region.

BLACK BUTTE

Besides having a distinctive charm, Black Butte is unique in other ways. It's the only major dam and reservoir project constructed by the Sacramento District on the west side of the great Central Valley. Further, it was the first to be constructed under a new Federal-State plan of cooperation.

Stony Creek, like the other streams in California, has a long history of floods of its own, and of having contributed greatly to those attributed to the Sacramento River, into which it empties. A product of long planning, beginning in the twenties, refined in the thirties and authorized in 1944, the project was nearly forgotten for many years thereafter. But the Christmas flood of 1955, and that of February 1958, brought the project back into focus by flooding Orland and Hamilton City, and adding to the destructive force of the mighty Sacramento. Almost a half million dollars in damages would have been prevented if the dam had been in place prior to these floods. Since its authorization as part of the Flood Control Act of 1944, the project had received several appropriations for studies and planning, and was nearly ready for the construction phase many times. But, for one reason or another, it never moved off dead center.

Spurred by the suffering experienced during 1955 and 1958, residents of Butte, Tehama and Colusa Counties joined with Glenn County to seek relief from the State of California. They sought immediate construction of the oft proposed project. Soon, the Federal-State cooperative plan was worked out. The bone of contention had been the repayment of that portion of the facility allocated to water conservation. There was no legal entity willing to furnish the necessary guaranties, and for awhile it appeared that the lack of one would halt plans for quick completion of the works. To save the situation, the State of California agreed to act as guarantor. After a resolution of intent was passed, the State Legislature appropriated several million dollars to underwrite the guaranty, and Black Butte was subsequently integrated into the Central Valley Project.

The Real Estate Division of the Sacramento District prepared an extensive document explaining to local landowners their rights with regard to government acquisition of their land: The need for the land, how the value of their property would be determined, and what steps to take if they didn't feel the offer made was fair. A great many more facts and general information were supplied in the paper, which proved a great help to local residents by clearing up rumors and false information that naturally accompany any such project.

On Saturday, June 4, 1960, a large group of local residents and dignitaries sweltered in 110 degrees heat while attending the groundbreaking ceremonies for Black Butte Dam. Following remarks presented by Colonel Howard Morris, Sacramento District Engineer, and Brig. Gen. R. G. MacDonnell, South Pacific Division Engineer, Major General William Cassidy, Assistant Chief for Civil Works, Office of the Chief of Engineers, delivered the principal address of the day. Following his presentation, Devere Mallon, previous owner of the dam site, stepped up and detonated a dynamite charge that marked the beginning of construction.

Actually, initial work had begun in March of 1960. Dam closure was achieved by November 1962, and the entire structure completed during December 1963. The dam was dedicated some months earlier, on June 29, 1963, another hot day. Speakers representing local, state and federal agencies all shared their thoughts and feelings about the importance of the facility. Following the introduction of Army Engineer personnel by Colonel Herbert Turner, Sacramento District Engineer,

BLACK BUTTE DAM SITE.

GROUND BREAKING AT BLACK BUTTE DAM SITE — JUNE 4, 1960.

BLACK BUTTE DAM AND LAKE
(Army Corps of Engineers Photo)

BLACK BUTTE DAM BID OPENING, MAY 10, 1966. LEFT TO RIGHT: A. J. SEAMAN, COLONEL H. A. MORRIS, SACRAMENTO DISTRICT ENGINEER, AND JIM CHADICK, RESIDENT ENGINEER.
(Army Corps of Engineers Photo)

Brigadier General Arthur Frye, Jr., South Pacific Division Engineer, delivered the dedicatory address. Skipping over the well-known benefits and purposes of the new dam, the General emphasized the local cooperation given the project, and the manner in which the dam would fit into the overall scheme of flood control and water resource development in the State of California.

Almost four years in construction, the project comprises an earthfill dam 140 feet high and 2,970 feet long and six dikes ranging in height from seven to thirty-eight feet with a total length of 3,005 feet. The spillway is an uncontrolled broad-crested weir with a crest length of 118 feet and having a capacity of 76,000 c.f.s. Total capacity of the reservoir, at gross pool, is 160,000 acre-feet. The major function of the project is flood control, but it also provides 56,800 acre-feet of new water annually for irrigation. Because of the many people coming to the lake to swim, fish, water-ski and just plain relax, the Sacramento District has undertaken an ambitious plan of recreational development at Black Butte. Besides the $14,500,000 federal first cost for the dam and reservoir, almost a million dollars has been earmarked for development of recreational facilities. Finally, the dam provides a large measure of security to the residents of Orland and Hamilton City, and to a transcontinental highway, a railroad and 64,000 acres of Sacramento Valley farm land.

NEW HOGAN

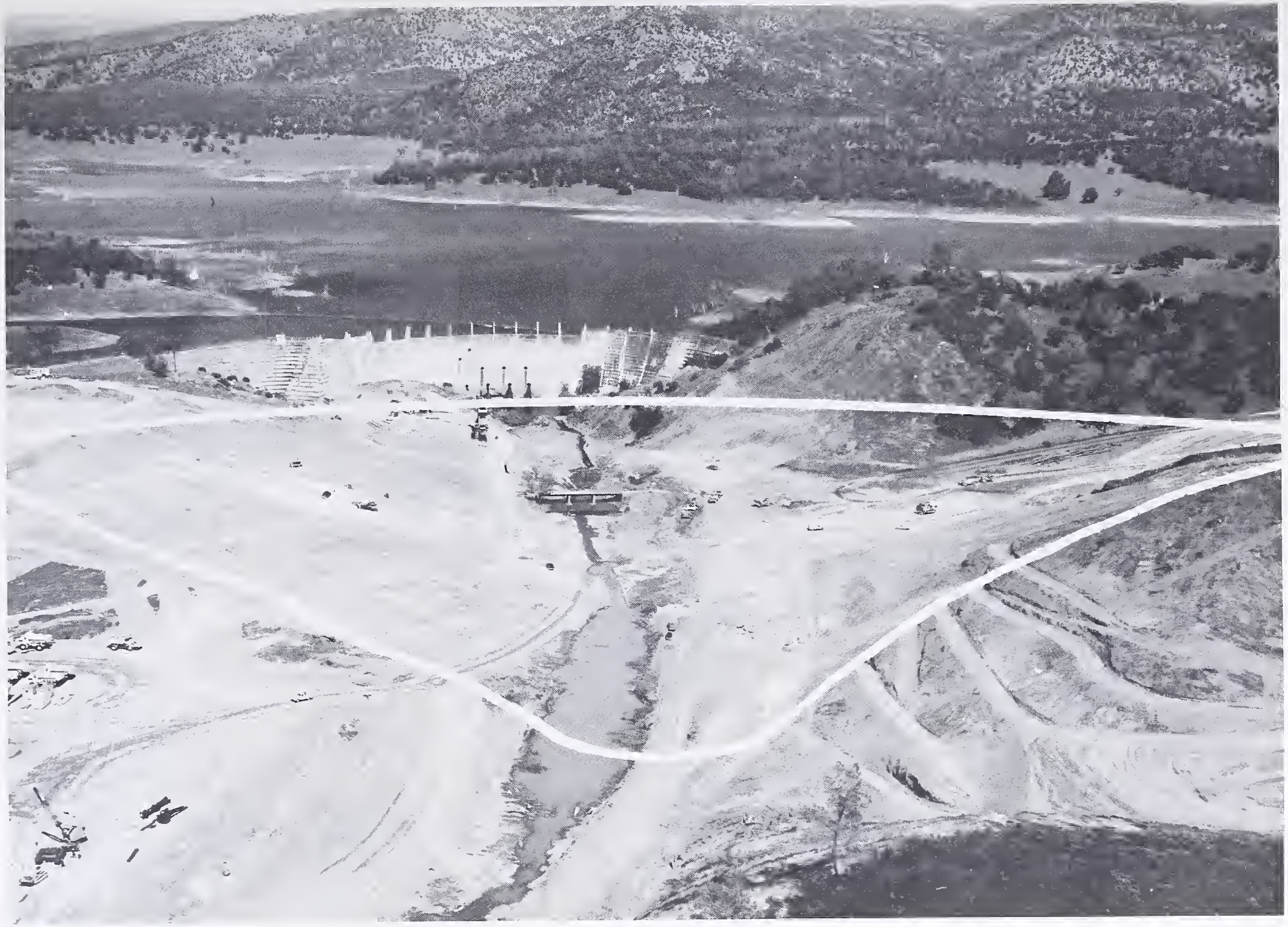
"Push the plunger, Walter!" The stubborn shaft descended into the detonator. Several hundred feet away mounds of iron ore, white sand and blue cement exploded in a flash of patriotic color. A second later, the sharp crack from the blast echoed across the ravine and richocheted off the old dam. All the while, Walter Hogan maintained a solemn countenance as the multi-colored clouds of dust rose into the still air, marking the beginning of construction of the New Hogan Dam and Reservoir. Some 300 spectators squinted and shielded their eyes as they watched one of the most unusual dedication ceremonies ever held.

It was altogether fitting for the 76-year-old, white-haired man to climax the occasion which meant the beginning of a new era of security for those living along the banks of the Calaveras River. Former Stockton city manager and city engineer, Walter Hogan had devoted a great deal of his active life to the control of floods from the Calaveras, which had so often threatened Stockton. Probably more than anyone else, he had labored to tame the river, for it was Hogan who conceived and fought for the original flood control dam that bore his name. The old dam, completed during the first years of the Great Depression, though inadequate, was a unique example of local initiative for self-protection. Unable to halt the full force of major floods, it nonetheless was the best that the people of Stockton could afford at the time, and through the years it had prevented many millions of dollars in damages and saved scores of lives.

Under the direction of the Greater Stockton Chamber of Commerce, and in cooperation with the Sacramento District, the groundbreaking ceremonies held on November 10, 1960, signaled the end of more than twenty years of campaigning by residents of the area for a major flood control dam. In his remarks at the time, General MacDonnell stated that, "The people of this valley have built the most remarkable economy of its kind in the world . . . it is proper that it be given protection and the means to expand."

Bids for the $16,000,000 project were opened on October 25, 1960. At about the same time, Colonel H. N. Turner, Sacramento District Engineer, appointed Donald Putnam as Resident Engineer for the New Hogan facility. As was the case with Black Butte Dam, the state acted as guarantor allowing construction to proceed more rapidly. The Department of Water Resources, acting for the state, assured the Corps of Engineers on March 5, 1959, that: The conservation (irrigation) services to be provided by the dam were needed and would be used; the cost allocated to the conservation function was acceptable to the state; the Department of Water Resources, on behalf of the state, would enter into a contract with the fed-

BORROW PIT AT NEW HOGAN DAM SITE — PHOTO TAKEN IN EARLY 1964.
(Army Corps of Engineers Photo)



DRAWING SHOWS POSITION OF NEW HOGAN DAM UPON COMPLETION. THE OLD HOGAN DAM IS SEEN IN THE BACKGROUND. APRIL 1961.
(Army Corps of Engineers Photo)

NEW HOGAN LAKE FILLING. THE ORIGINAL HOGAN DAM IS FAST DISAPPEARING BENEATH THE NEW LAKE
(Army Corps of Engineers Photo)

eral government for repayment of the project cost allocated to conservation. Just a year later, in the spring of 1960, such a document was executed with the Bureau of Reclamation.

For the next three and a half years, work went on day and night to effect rapid completion of the project. Through the intense heat of San Joaquin Valley summers and the muck and mire fomented by cold winter rains, men and machines choked on dust and slogged in the slippery mud and brought closure to the dam in November, 1963. Eight months later, in June, 1964, the project was completed for operational use.

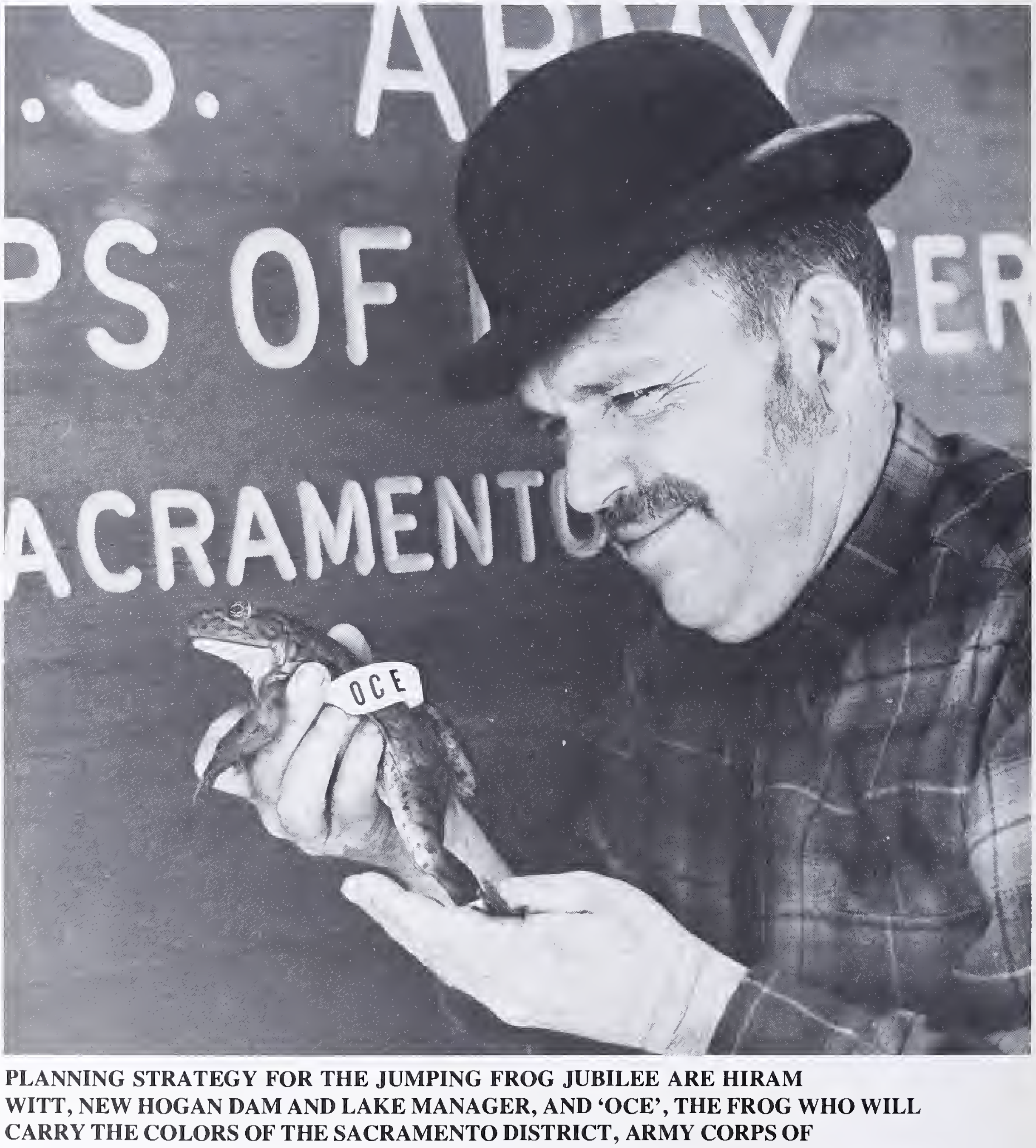
Their many months of toil had wrought a magnificent structure that sits astride the Calaveras River some twenty-eight miles northeast of the City of Stockton. The main dam, located immediately downstream from the old Hogan Dam, is a rockfill barrier having an impervious earth core and a maximum height of 200 feet and a length of just under 2,000 feet. To create the 325,000 acre-foot reservoir, four dikes were also constructed. They are rolled earthfill structures ranging from 10 to 18 feet in height, and if placed end to end would cover 1,355 feet. A gated spillway, (3 tainter gates, 38' x 36') 130 feet in length, with a capacity of 106,400 c.f.s., regulates the flow from the reservoir.

It was a long uphill fight to get the job done. Planning funds were initially allocated in Fiscal Year 1945, but things moved slowly. Then the Korean War brought a halt to the planning, which wasn't resumed until 1957. Finally, on a bright, sun-drenched Saturday morning in May, 1964, the project was dedicated. From reviewing the evidence, the planning and execution of the dedication ceremony seemed almost as involved as building the dam. Bands played, howitzers thundered, helicopters hovered about, sky divers fell out of the blue, while a grand entourage of dignitaries reviewed the troops and spoke on the subject of the day. The principal speakers were General Jackson Graham, Director of Civil Works, U. S. Army Corps of Engineers, and Congressman John J. McFall of the 11th U. S. Congressional District. Attending from the Sacramento District were Lieutenant Colonel C. R. Teagle, Deputy District Engineer; Amalio Gomez, Chief, Engineering Division; O. H. Hart, Chief, Construction-Operations Division; Ronald Thompson, Chief, Operations Branch; Bill Doyle, Chief, Planning Branch; Ansel Myers, Resident Engineer for New Hogan Dam; Arnold Lee, District Photographer; Clyde Gorman and Carl Greenstein from the Technical Liaison Office (Public Affairs Office).

After all the local, state and federal officials were introduced and the speeches made, Mrs. Frances H. Winter, daughter of the late Walter Hogan (he had died 5 April 1962 and never saw the fulfillment of his dream), stepped up to the rostrum and shared a few brief thoughts with the audience. Then, to climax the gala event, she, her daughter Pamela, and General Graham took flare guns in hand, pointed them skyward and fired — the facility was properly and officially dedicated. Six days later, 29 May 1964, Max Sweet, President of the Greater Stockton Chamber of Commerce, wrote Colonel Mathe, District Engineer, to thank him for the efforts of Corps' staff in handling the ceremonies.

Indeed, the project and all the men responsible for its completion are held in high esteem by the residents of Stockton. For the dam and reservoir provide flood protection for 46,000 acres of highly developed agricultural land along the Calaveras River and to the residents of another 14,000 acres of urban and suburban Stockton. Their transportation facilities, industries and military installations are afforded security as well. For the farmers of the region, the project adds 71,800 acre-feet of new water each year to an area where the supply was inadequate and overdraft pumping was depleting ground water supplies. Moreover, it's estimated that if a major flood occurs, operation of the dam in conjunction with downstream improvements would prevent damages of $50,000,000. Cause for celebration indeed!

NEW HOGAN DAM AND LAKE — JULY 1969.



PLANNING STRATEGY FOR THE JUMPING FROG JUBILEE ARE HIRAM WITT, NEW HOGAN DAM AND LAKE MANAGER, AND 'OCE', THE FROG WHO WILL CARRY THE COLORS OF THE SACRAMENTO DISTRICT, ARMY CORPS OF ENGINEERS. ANGELS CAMP, SCENE OF THE ANNUAL FROG JUMP, AND NEW HOGAN DAM ARE BOTH IN CALAVERAS COUNTY, CALIFORNIA, WHERE FROG JUMPING CONTESTS HAVE BEEN HELD FOR OVER A HUNDRED YEARS. 'OCE' GOT HIS NAME FROM THE INITIALS, OFFICE OF THE CHIEF OF ENGINEERS. PHOTO TAKEN 16 MAY 1967.

(Army Corps of Engineers Photo)

RENO, NEVADA, AFTER RECESSION OF TRUCKEE RIVER FLOODWATER. NOTE HIGH WATER MARK ON THE RIVERSIDE HOTEL. NOVEMBER 1950.

(Army Corps of Engineers Photo)

MARTIS CREEK

Hidden away in a lonely, sagebrush-covered valley, a few miles southeast of Truckee, and just off the road to the north shore of Lake Tahoe, is Martis Creek Dam and Reservoir. Driving through the valley in the middle of summer, gamblers headed for North Shore to "pay their dues" seldom imagined that, when fed by spring runoff and mountain thunder showers, Martis Creek could grow to enormous proportions. Racing through the highland, it soon merges with the Truckee River, which in turn cuts a path through the heart of Reno on its way to Pyramid Lake. It is in downtown Reno that flooding problems have often occurred. A part of the solution are the channel improvements completed by local interests and the Corps. The other part is the dam and reservoir on Martis Creek about two miles above its confluence with the Truckee River, and about thirty-two miles upstream from Reno.

The $8,000,000 project consists of an earthfill dam 113 feet high and 2,670 feet long (crest length). While the primary purpose of the 20,400 acre-foot reservoir is flood control, it will also offer increased recreational opportunities and will augment the existing water supply in the Truckee River Basin. Authorized by the Flood Control Act of 1962, preconstruction planning was started early in 1964, with initial construction getting under way three and a half years later, in the fall of 1967. In the spring of 1970, the contract was awarded for the main dam. It was at this point that the local interests began their part of the work. Channel improvements along the Truckee River in Reno. A year and a half later, about the time Reno pre-schoolers were dreaming of the Great Pumpkin and pestering their folks for a witch's costume, the engineers from Sacramento achieved closure of the main dam in October 1971.

MARTIS CREEK DAM AND LAKE

THE SPILLWAY OF THE MARTIS CREEK DAM, UNDER CONSTRUCTION BY THE PERINI CORPORATION FOR THE SACRAMENTO DISTRICT, CORPS OF ENGINEERS. PHOTO TAKE 26 AUGUST 1970.
(Army Corps of Engineers Photo)

LEVEES

SACRAMENTO — SAN JOAQUIN RIVERS AND TRIBUTARIES

The Flood Control Act of 1944 did more than authorize dams and reservoirs to protect valley residents. Not as glamorous, perhaps, as the big dams, but vital to the overall blanket of protection are the systems of levees and channels that were raised, dug, lengthened, widened and/or strengthened as a part of the 1944 Act.

Beginning in the northern end of the valley the Sacramento Flood Control Project was modified by the 1944 Act (and subsequent Acts). Known as the Sacramento River and Major and Minor Tributaries project, it is a part of the $163,600,000 flood control and irrigation work that began in 1917 and continues to the present. Construction of this phase began in Fiscal Year 1949, but because of the Korean conflict was suspended by Presidential directive of 21 July 1950. Before the work was halted, improvements were completed on Deer Creek located about ten miles south of Red Bluff, and along Butte and Little Chico Creeks that run a few miles south of Chico. Levee and canal construction was again resumed in Fis-

SACRAMENTO WEIR CONNECTING THE SWOLLEN SACRAMENTO RIVER WITH YOLO BYPASS — PHOTO TAKEN DECEMBER 1955.
(Army Corps of Engineers Photo)

BREAK IN EAST LEVEE OF SAN JOAQUIN RIVER BELOW MOSSDALE. FLOODING OF RECLAMATION DISTRICT NO. 17 — DECEMBER 1950.
(Army Corps of Engineers Photo)

cal Year 1957, with work on Cherokee Canal, Elder, Chico and Mud Creeks, and Sandy Gulch. Then in 1964, the revetment of bypass levees was begun along the Sutter, Yolo, Tisdale and Sacramento Bypasses. For the project as a whole, approximately 72 miles of channel improvements, and 107 miles of levees and bypass revetment to prevent erosion are involved in the project. Hopefully the bypass levee revetment features included in the work will not only afford added security to the flood plain lands next to the bypasses, but will also lessen the requirements for levee repairs during extreme high water.

Moving south past Sacramento to the region a few miles north of Stockton, one comes upon Bear Creek and its tributaries. Forty-one miles of levees and 24 miles of channel improvements have made the stream a valuable ally to those who farm some 30,000 acres along its banks. Because of work by the Sacramento District, large tracts of vineyards, orchards and row-crops are now safe from the sometimes violent Bear Creek. The federal cost of the project, $3,185,000, was largely repaid during the floods of 1964 and 1966, when the improvements prevented almost a million and a half dollars in damages. First studied under the "308" reports, the project was authorized in 1944. Advance planning was initiated in Fiscal Year 1947, but suspended in Fiscal Year 1951 while awaiting agreement with local interests regarding the extent of the work to be accomplished. Classified "deferred" in the mid-fifties, it was reviewed in the early 1960s, with construction finally getting under way in the summer of 1963. Four years later, on July 20, 1967, the work was completed.

South of Stockton, the San Joaquin River twists and coils like a can of worms. Fed by hundreds of streams large and small, the main channel and many of its tributaries would often overtop their banks when pressured by spring runoffs. Long recognized as a serious situation, the lower San Joaquin River, from the Merced River to the Delta, has been studied since before the turn of the century. Intensive surveys were conducted as part of the "308" studies and plans were laid to improve conditions during the late thirties. Though authorized in the 1944 Act, work was not begun until 1956. By raising and strengthening existing levees, building new ones, reveting river banks, and removing snags in the main channel of the San Joaquin, flood protection to suburban tracts in the vicinity of Stockton and to 140,000 acres of prime farm land in the lower San Joaquin Valley is provided. When one considers the fact that had the project been completed prior to the 1955-56, 1958 and 1966-67 floods, almost $3,000,000 in damages would have been prevented, it is not difficult to see why local interests were anxious to cooperate in its quick completion.

Residents of the area coordinated their plans for improvement of the river with those of the Sacramento District to ensure the effectiveness of the Corps work. In addition to bearing the cost of the improvements upstream from the mouth of the Merced River, local interests were required to furnish flowage rights to lands on either side of the main stem of the San Joaquin, lands, easements and rights-of-way for levee construction. They also had to make all necessary relocations and modifications to utilities, and to maintain the levees and channel improvements once they were completed. By July 1968, total local costs amounted to over twenty-eight million dollars, while federal costs ran to less than half that amount. All units of the project have now been transferred to the State of California and are operated and maintained by the State Reclamation Board. As an integral part of the flood control plan for the San Joaquin Basin, the project was designed to supplement the completed and authorized reservoirs on the Stanislaus, Tuolumne and upper San Joaquin Rivers.

Still further south is Big Dry Creek Dam, located ten miles northeast of Fresno and not quite that distance due south of the Bureau of Reclamation's Friant Dam. The Big Dry Creek project comprises a forty-foot high earthfill dam across Big Dry Creek and diversion facilities both upstream and downstream from the dam. By storing 16,250 acre-feet of water and by diverting the flows of Dog and Big Dry Creeks to Little Dry Creek and then in to the

FLOODING BY DUCK CREEK IN VICINITY OF SHARP'S LANE, SOUTH OF STOCKTON. DECEMBER 1950.
(Army Corps of Engineers Photo)

MAZE ROAD BRIDGE OVER SAN JOAQUIN RIVER BETWEEN TUOLUMNE AND STANISLAUS RIVERS. VIEW LOOKING NORTHEAST. DECEMBER — 1950.

(Army Corps of Engineers Photo)

San Joaquin River, extensive flood protection is afforded the urban and suburban areas of Clovis and Fresno. Though a relatively small and inexpensive project ($1,369,931), it, too, contributes to the overall pattern of defense against floods that are being systematically brought under control throughout the San Joaquin River Basin.

The work was authorized by the Flood Control Act of 1941, but construction wasn't begun until the spring of 1947. Considered complete in 1948, it was later discerned that remedial work was needed to control side-hill erosion. This phase was initiated in October 1952, and completed by March of 1955. Like so many other flood control projects, Big Dry Creek Dam more than justified the cost of construction by saving an estimated $3,000,000 in damages during the Christmas flood of 1955. And, as is the case with several other projects built by the engineers from the Sacramento District, Big Dry Creek Dam and Reservoir has been transferred to the State of California for operation and maintenance.

The Flood Control Act of 1954 held special interest for the residents of Sacramento. For it was this Act (Public Law 780) that put the finishing touches on the flood control works along the American River downstream from Folsom Dam. In the spring of 1957, engineers from the Sacramento District began the construction of seven miles of levee along the right (north) bank of the American River. Beginning near the Elvas Bridge in eastern Sacramento, the project extends upstream to the bluffs near the City of Carmichael. Old levees in the area which had been overtopped in the extensive flood of 1950 were enlarged, set back from the river and tied into existing works. The $2,000,000 improvement forms an integral part of the flood control plans for the Capital City and its suburbs. Since completion in the fall of 1958, the levee has prevented many millions of dollars in damages by supplementing the regulatory facilities of Folsom Dam. Moreover, it has allowed the often flooded hop fields of the area to be transformed into a safe tract on which hundreds of millions of dollars worth of fine homes and apartments have been constructed. The project will prevent an estimated $95,000,000 in damages, working with Folsom Dam, should a major flood occur. As an added safety feature, pumping facilities were included in the project for disposal of interior drainage.

The same flood control legislation also provided for work on the Truckee River north of Lake Tahoe. Actually the project extends all the way from Lake Tahoe to Pyramid Lake. Late in the summer of 1959, District personnel began enlarging the channel of the Truckee River just below the outlet structure near Tahoe City on the California side of the lake. When finished, this part of the work increased the capacity of the outlet to some 2,500 c.f.s. when the lake level is 6,228 and to 3,300 c.f.s. when the lake is at 6,229.1 feet elevation. This had two effects: First, the increased releases have alleviated flood damages to lakefront homes, but they also necessitated limited amounts of flood control work to be accomplished between the lake and the City of Truckee to prevent flood damages along this section of the river. In the main, this work consisted of low levees and channel improvements at intermittent locations. By the spring of 1960, the engineers had completed additional channel work downstream from Reno where the river winds through Truckee Meadows. This improvement doubled the capacity of the stream, from 3,000 c.f.s. to 6,000 c.f.s. for a distance of about seven and a half miles. Second, to compensate for the increased flow through this region, the channel was improved all the way downstream to Pyramid Lake by clearing and snagging.

Considered an interim improvement project, it is meant to be a part of the basin plan for flood control and related purposes being constructed by the U. S. Bureau of Reclamation (Washoe Reclamation Project). The Corps project affords at least partial security to residents on the shores of Lake Tahoe and to some 2,000 acres of agricultural land along the Truckee River. Federal costs for the phases completed thus far have been just over a million dollars.

One hundred and thirty air miles due west of Tahoe, the Sacramento District has completed

AMERICAN RIVER OVERFLOW. LOOKING NORTH ALONG FULTON AVENUE. NOVEMBER 1950.
(Army Corps of Engineers Photo)

FLOODING IN UPPER LAKE, CALIFORNIA, DURING THE WINTER OF 1906-1907.
(Photos – Mrs. Eva M. Sanborn)

the Middle Creek Improvement Project near the town of Upper Lake in Lake County. This work, like the American River levees and those along the Truckee, was authorized by the Flood Control Act of 1954. Construction was begun in 1958 but required nine years to complete because of the subsidence of placed material. The reason for the sinking is that a good deal of the work was done on reclaimed swamp land and lakebed. The project extends from the north shore of Clear Lake, the largest natural lake lying entirely within California, to the region of the Upper Lake Racheria Indian Reservation.

Even though the work cost but $2,600,000, it consists of several elements. Existing levees were enlarged and new ones built. Seven miles of channel improvements were made along lower Middle Creek and to its tributary streams. To protect the town of Upper Lake, a 4,000-foot-long diversion channel was dug to carry the excess flood flows from Clover Creek around the town and safely join them with those of Middle Creek. In addition, a pumping plant near Bloody Island was built to dispose of interior drainage.

Clear Lake itself is something of a geological curiosity. Actually it is two lakes made one by a lava flow that blocked the flow of Cache Creek, causing the lower lake to spill over into the upper. Later the upper outlet that drained the lake to the Russian River was blocked by a massive landslide, causing the lake to rise and finally cut a channel through the lava dike on Cache Creek. For thousands of years, Pomo Indians fished its clear blue waters in the shadow of the volcanic Mt. Konocti until they were driven off or killed by the white settlers. In fact, the name for the Corps constructed pumping plant (Bloody Island) on Middle Creek takes its name from a landmark that was the site of an Indian slaughter.

In a futile attempt to save their land, Indians of the area struck back at the Mexican and American settlers. Finally, the newcomers called in the military from Benicia Arsenal to exterminate those not already killed. Two whaleboats, filled with soldiers, and mounted with small brass howitzers, attacked the natives, pushing them to a little island at the north end of the lake where they made a last stand. The ensuing slaughter left the islet with the name, "Bloody Island" (Bloody Island Pumping Plant). As the marshland at the far end of the lake was reclaimed for farming, the island disappeared, but not the name.

A project of particular interest to Colonel James C. Donovan, Sacramento District Engineer, and to his immediate predecessors, was the Sacramento Bank Protection Project. The Flood Control Act of 1960 authorized the modification of the existing Sacramento River Flood Control Project, making it a long-range, one hundred million dollar undertaking. Actually, many of the concepts contained in the new authorization were first put forward during the Depression by the courageous Thomas Jackson.

Preconstruction planning for the initial ten-year phase of the work was begun soon after the authorization was made during the summer of 1960. In June of 1963, construction crews began the long and difficult task of bank erosion-prevention work that would eventually provide and maintain the integrity of the levee system that affords protection to millions of residents of the Sacramento Valley and the Delta region. Over the years, it is hoped that new work will reduce the costs of emergency repairs and further diminish the amount of land lost to the forces of erosion. The need for downstream dredging should also be reduced. By the fall of 1972, almost 40 miles of bank protection work had been completed at critical levee erosion sites in the Delta alone. It is expected that $40,200,000 will be spent on this type of work by the end of the first ten-year phase of construction, $26,800,000 of it federal, $13,400,000 non-federal, which includes some $4,100,000 in cash contributions.

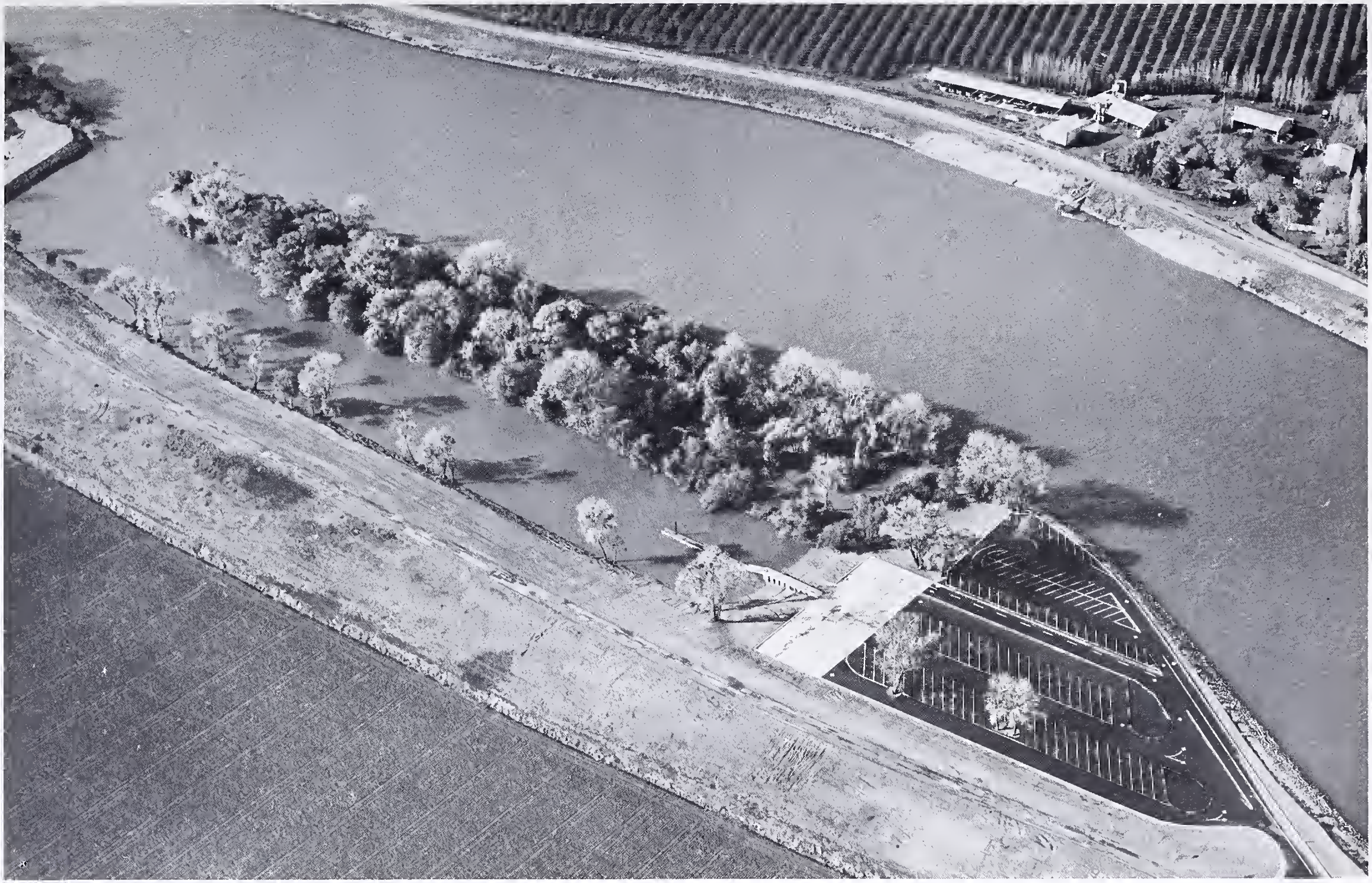
Added dimensions to the broadened program are the extensive recreational facilities being built as an integrated part of the bank protection work. The boat launching and automobile parking area developed at Hogback Island in Steamboat Slough is an excellent example of this kind of construction. Other recreation sites have been developed at Live Oak on the

UPPER LAKE, CALIFORNIA — DECEMBER 1937
(Photos – Mrs. Eva M. Sanborn)

COLONEL HOWARD A. MORRIS, SACRAMENTO DISTRICT ENGINEER — JULY 1959-JUNE 1960.
(Army Corps of Engineers Photo)

CONGRESSMAN HAROLD T. (BIZZ) JOHNSON (D) SECOND DISTRICT (CENTER) LOOKS OVER THE $30,000 BANK PROTECTION JOB COMPLETED ON 22 OCTOBER 1968 BETWEEN CHICO LANDING AND RED BLUFF ON THE SACRAMENTO RIVER. ANSEL J. MYERS (LEFT), VALLEY RESIDENT OFFICE ENGINEER, AND C. A. STROMSNESS, MAYOR OF THE TOWN OF TEHAMA, MET WITH CONGRESSMAN JOHNSON ON THE RIVERBANK NEAR TEHAMA WHERE VALUABLE FARMLAND HAD BEEN THREATENED. THE SACRAMENTO RIVER BANK PROTECTION PROJECT IS A RESPONSIBILITY OF THE SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS.
(Army Corps of Engineers Photo)

BANK PROTECTION PROJECT — SACRAMENTO RIVER
(Army Corps of Engineers Photo)



HOGBACK ISLAND AQUATIC PARK AND RECREATION SITE ON STEAMBOAT SLOUGH IN THE SACRAMENTO-SAN JOAQUIN DELTA. THE PROJECT FEATURES TWO BOAT LAUNCHING RAMPS, PARKING FACILITIES, A SANDY BEACH, TRAILS AND PICNIC AREAS. THE SACRAMENTO DISTRICT, U. S. ARMY CORPS OF ENGINEERS, CONVERTED THE ISLAND FROM ITS FORMER WILD STATE AS PART OF AN ADJACENT BANK PROTECTION PROJECT. THE PARK, WHICH TOOK EIGHTEEN MONTHS TO COMPLETE, HAS BEEN TURNED OVER TO THE STATE RECLAMATION BOARD FOR OPERATION AND MAINTENANCE.
(Army Corps of Engineers Photo, 8 Dec 67).

Feather River, and at Garcia Bend, on the Sacramento River just south of Sacramento.

Until a few years ago, Walnut Creek wandered through a quiet little town of the same name, found just over the hill from the busy City of Oakland. In 1960, fewer than 10,000 people lived in Walnut Creek, but only ten years later the population had grown to almost 50,000. Moreover, the other small Contra Costa County towns found nearby have also grown in about the same proportion. Most of the time the creek is as quiet as the town used to be. Even when the creek, and the tributaries that feed it, used to run through the streets of the town as well as in their proper channels, not a lot was ruined, simply because there wasn't a lot to ruin. With the tremendous popularity of the area, however, especially demonstrated by those who work in the Bay Area, there is now much and many to suffer when the creek is allowed to escape its natural channel. Even though the population was relatively sparse during the middle and late fifties, the floods of 1955-56 and 1958 put the town under water, resulting in more than three million dollars in damages. Conditions being what they are today, the partially completed project, in conjunction with other facilities, will prevent damages estimated at thirty million dollars, should a major flood strike the area.

Authorized by the Flood Control Act of 1960, the improvements include: Extension of existing levees; construction of new levees; channel improvement and enlargement on Walnut Creek and on the lower portions of Pacheco, Grayson, San Ramon, and Los Trampas Creeks. Post-authorization changes, however, have modified the original plan so that now channel work is also to be done on Pine and Galindo Creeks.

Preconstruction planning was initiated in November 1961. Actual work on the $31,000,000 project began during the summer of 1964, and has been continuing on a rather uncertain course since that time. It seems that all parties concerned can't agree upon a path to follow in order to reach basically the same goals. Nonetheless, like most other projects, it has unique features all its own. It affords practical security to the residents of the beautiful city of Walnut Creek, and to approximately 6,100 acres of flood plain at and below the city.

One of the latest projects to be completed, incorporating both levee and channel improvements, is the Mormon Slough Project located downstream from New Hogan Dam on the Calaveras River, seventeen miles east of Stockton. The original flood control work done on this part of the river consisted of a dam and diverting canal, which diverts Mormon Slough, a distributary of the Calaveras, back into the river about four miles east of Stockton. The dam and diverting canal were completed back in 1910.

The new work is designed to supplement the flood control aspects of the New Hogan Dam and Lake by carrying increased flows originating from the reservoir itself and from the drainage area below the dam. This has been accomplished by minor channel enlargement of Mormon Slough between the small town of Bellota and Jack Tone Road, and substantial channel work and modification on the lower reaches of Mormon Slough and the old diverting canal. New levees were constructed along the north bank of the diverting canal, and on both sides of lower Mormon Slough, as well as on the south bank of Potters Creek, another small stream in the area.

Like New Hogan Dam, the project is an essential link in the flood control chain that has civilized the Calaveras River Basin. Preconstruction planning for the work was begun in the winter of 1964. Three and a half years later, just before Halloween 1967, construction of the project got under way. And by the time school children were exchanging valentines in 1970, most of the work was finished. Finally, by Christmas 1971, the remaining miscellaneous minor touches were put on the work to make it a completed unit.

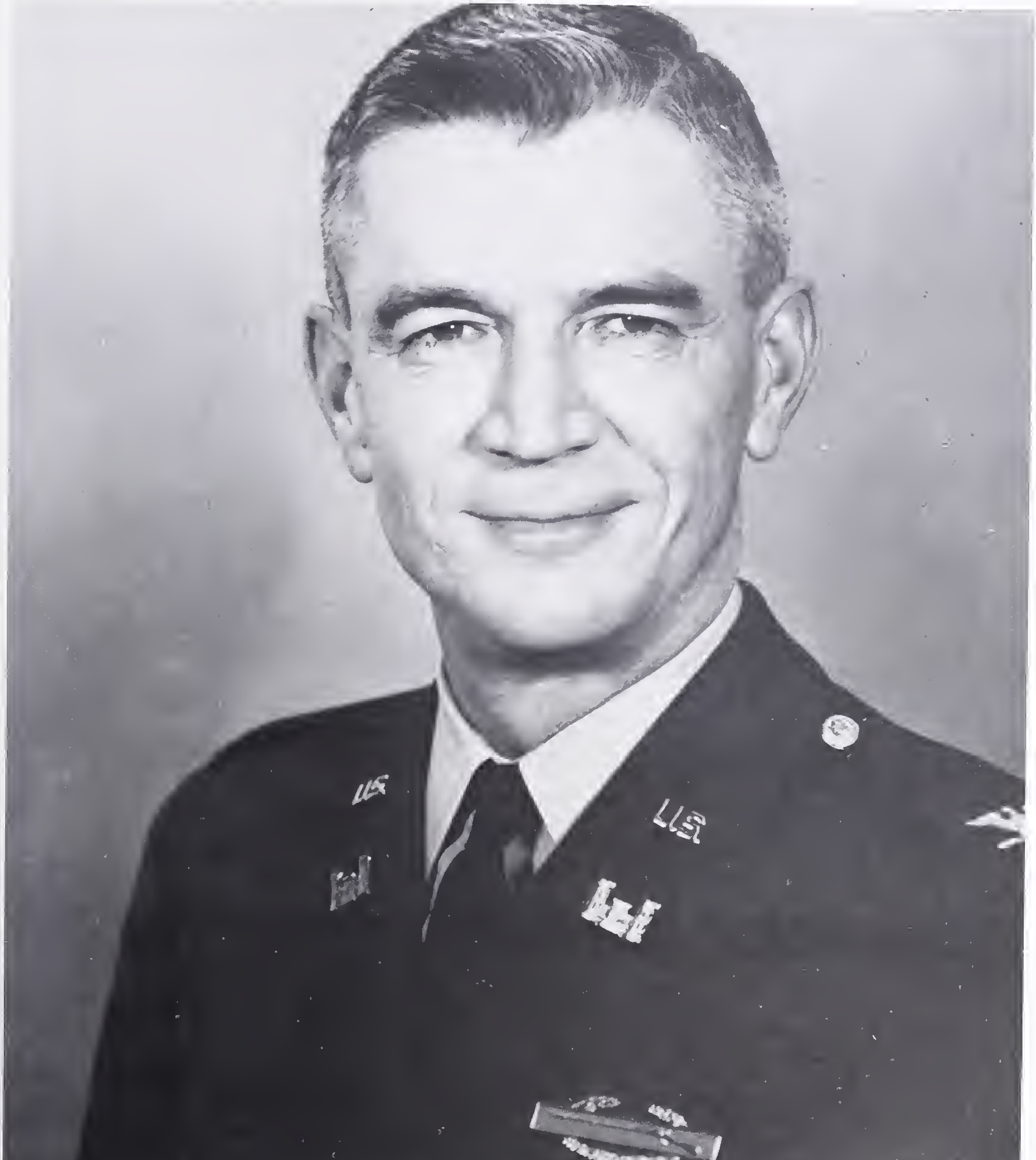
EMERGENCY WORK

For just about a hundred years now, Corps of Engineers officers have been working in the great Central Valley of California. While the Sacramento District has grown so that it now covers much of the western United States, the

center of the flood control effort yet remains bounded by the Cascades on the north, the Tehachapis on the south, the Coast Ranges on the west and the mighty Sierra Nevada on the east. During the last century, the Corps has done all within its power to protect the people who make their homes within this perimeter. But even after the expenditure of millions of man-hours and millions of dollars, the forces of nature still overcome all attempts to subdue them. Sometimes it's a warm rain in early spring that falls on a "ripe" snowpack, causing it to melt and add to the runoff; then down the steep sides of the Sierra a wall of water spills into the valley, overtopping natural banks and causing levees to burst. Occasionally, in the middle of summer, when the Delta is crowded with pleasure craft, a peat-founded levee fails, allowing the waters to rush over the lower-than-sea-level islands, destroying all in their wake. Sometimes, a terrific wind storm will tear trees out of the levees by their sod-holding roots. Water pours into the ulcer formed in the meat of the bank, and before long a farmer sits with his wife and children on the roof of his flooded home, wondering, "whose side is God on, anyway?" In the short view at least, it matters little what the cause of the disaster may be. The fact is someone must act and act quickly and intelligently to stop the flooding and effect emergency repairs. Very often, in the great Central Valley as well as in the rest of the nation, that someone is the Corps of Engineers.

Unlike new project construction, which requires specific Congressional authorization, continuing Congressional authorization permits the Corps to undertake emergency work immediately. Three general Congressional authorizations, with annually appropriated funds, exist to allow this quick action: Emergency bank protection — Section 14, 1946 Flood Control Act; Snagging and clearing — Section 208, 1954 Flood Control Act; Flood-fighting, rescue, and repair work — Public Law 99, 84th Congress, and antecedent legisla-

DOWNTOWN WALNUT CREEK, CALIFORNIA — 1958
(Army Corps of Engineers Photo)



COLONEL HERBERT N. TURNER, SACRAMENTO DISTRICT ENGINEER — JUNE 1960 — JULY 1963.

(Army Corps of Engineers Photo)

A PORTION OF THE WALNUT CREEK PROJECT, CONTRA COSTA COUNTY, CALIFORNIA, ALREADY COMPLETED. THIS VIEW FACES A SOUTHEASTERLY DIRECTION AND IS JUST UPSTREAM FROM THE TOWN OF PLEASANT HILL. TOTAL COST OF THE PROJECT IS ESTIMATED AT OVER $32 MILLION. CONSTRUCTION STARTED IN 1964.
(Army Corps of Engineers Photo)

COLONEL CRAWFORD YOUNG (RIGHT), SACRAMENTO DISTRICT ENGINEER, AND O. HAVEN HART, CHIEF OF CONSTRUCTION-OPERATIONS FOR THE DISTRICT, VISIT THE WALNUT CREEK FLOOD CONTROL PROJECT ON 26 JULY 1968
(Army Corps of Engineers Photo)

TINTED CONCRETE FOR WALNUT CREEK WAS THE SUBJECT OF DISCUSSION BETWEEN WALTER LUCAS, CHAIRMAN OF THE ACTION FOR BEAUTY COUNCIL; COLONEL GEORGE B. FINK, SACRAMENTO DISTRICT ENGINEER; AND JOHN RONAYNE, COMMISSIONER OF THE CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT. A LIGHT BROWN TINT WAS SELECTED TO IMPROVE THE APPEARANCE OF THE SIDEWALLS OF ABOUT 1,000′ OF THE CHANNEL AS PART OF THE FLOOD CONTROL PROJECT BEING BUILT BY THE SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS, IN WALNUT CREEK, CALIFORNIA.

COLONEL ROBERT E. MATHE, SACRAMENTO DISTRICT ENGINEER — AUGUST 1963 — JUNE 1966
(Army Corps of Engineers Photo)

AT THE BETHEL ISLAND LEVEE BOIL, JULIO HRIBERNIK, BETHEL ISLAND BOARD OF DIRECTORS IN CHARGE OF LEVEES, LISTENS AS PAUL McQUEEN, DUTRA DREDGING CO., SPEAKS WITH DALE DOBLE, CHIEF EMBANKMENT DESIGN SECTION, SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS. A POSSIBLE DISASTER INVOLVING LIFE AND PROPERTY ON BETHEL ISLAND WAS AVERTED BY QUICK ACTION ON A LEVEE BOIL RUNNING ABOUT 120 GALLONS A MINUTE ON THE HORSESHOE BEND AREA OF PIPER SLOUGH.

(Army Corps of Engineers Photo)

tion. Several other authorizations are on the books as well, but it is P. L. 99 that is most often used in the valley when things go amiss. Even so, the District acts under this authorization only at the request of responsible local entities, and only after it has been determined that the non-federal capabilities have been exhausted.

In recent years, emergency work has been completed by the District under Public Law 91-606, at the specific request of the Office of Emergency Preparedness (OEP), after an area has been designated by the President as a federal disaster area. A case in point was the failure of a levee protecting Andrus-Brannan Island on 21 June 1972. When the levee failed, Colonel Donovan and his men mobilized flood fighting operations under P.L. 99 in a desperate struggle to save the town of Isleton. Their work went unrewarded — Isleton was inundated. Forty-eight hours later, Colonel Donovan requested authority and funds to close the breached levee under the same law, only to find that such repair did not qualify under this law because the failure was not the result of a flood. After the President declared the Delta island(s) a federal disaster area, the OEP authorized the necessary work under authority of P.L. 91-606, and requested the Sacramento District to supervise the restoration. On the first day of July, men and equipment began the frustrating job of plugging the hole in the levee. Finally, on 24 July the gap was filled and thoughts could be turned to the long and costly work ahead — pumping the water out of the lake that had been formed inside the island. Such has not always been the case. In 1938, the levees protecting Franks Tract, Mandeville, Venice, and several other smaller islands failed. Thirty-five years later, Franks Tract is still under water.

Since 1950, eight of the major Delta islands have been flooded because of levee failures. In almost all cases the reason has been the fact that the levees, many of which are over 100 years old, are built upon, and often constructed of unstable peat soil. During the early years of the 20th century, dozens of levees failed, but since the last major reclamation work, when many of the old levees were raised and strengthened, there have been relatively few major levee breaks.

The Sacramento District has spent some four million dollars for emergency work in the Delta alone. About three million dollars has gone for flood fighting rescue and repair, while the remainder has been expended for the removal of wrecks and obstructions, emergency bank protection, and for snagging and clearing. Millions more have been given to emergency work accomplished along the bypasses and rivers of the District.

It's a mistake, though, to visualize the engineers just sitting about waiting for a crisis to develop before they figure out what to do. On the contrary, they are constantly checking their work, and probing the District for weak spots that may be potential disaster areas. On occasion, they even simulate floods to check out the system. It was, perhaps, ironic that one such exercise was conducted just a year prior to the massive Christmas floods of 1955. Under the direction of Colonel Ely, Sacramento District Engineer, the men of the Corps fought a mock flood for more than a week during the latter part of October and early November 1954. The theoretical storm soaked northern California and the valley until the region was thoroughly saturated. From the Division office came news of additional heavy rains. At the same time, Colonel Ely was given streamflow and other related make-believe data. From then on, the District was on its own to handle the theoretical emergencies as if they were the real thing. To add a note of realism, the floods were based on what actually happened in the years 1862, 1916, 1938, and 1950 — the wettest years of record to that time.

The purely simulated rainstorm, approximating one of the worst in history, sent the rivers on a rampage. Water spread over the valley from Red Bluff to Bakersfield. Appropriately named "Operation Splash", the crisis was developed through the day by the use of sealed envelopes, each marked so that it would be opened at the predetermined time. Action taken on the basis of the information concealed in the envelopes depended entirely upon the

EMERGENCY LEVEE REPAIR WORK — SHERMAN ISLAND IN THE SACRAMENTO-SAN JOAQUIN DELTA — 13 FEBRUARY 1969.

JUNK CARS ON THE LEVEE REDUCE EROSION FROM WINDBLOWN WAVES IN THE TULARE LAKE BASIN WHERE THOUSANDS OF ACRES WERE FLOODED BECAUSE OF THE RECORD SNOWFALL AND RAINFLOODS IN THE REGION. APRIL 1969.

A SNOWMELT STREAM BEGINS TO CARVE ITS WAY THROUGH A SHEER BLANKET OF WHITE.

discretion of whoever was in charge of each phase of the operation. The South Pacific Division supplied the umpires to keep score and determine how well the District achieved its goals. When it was all over, we had "saved" scores of lives and "prevented" millions in damages, and the District had worked out some of the bugs in the system.

SNOW RESEARCH

Another way to predict and thus protect against floods is to actually measure the amount of water stored in the vast snow-fields of the high Sierra. For many years this could only be accomplished by sending men into the mountains on foot. These unsung heroes would snowshoe and ski their way into the dangerous wilderness to survey the frozen resources of the coming spring. In 1945 the Corps of Engineers and the U.S. Weather Bureau set up the Central Sierra Snow Laboratory at Soda Springs near the 7,000-foot Donner Summit. The Sacramento District gave direct technical support to the lab in an effort to gain additional knowledge about snowmelt runoff. The data collected here was also supplemented by aerial photographs taken from light planes.

In December 1953, Colonel Ely announced the details of an experiment to measure the water content of snow by using radioactive cobalt. The concept took shape at the Snow Lab near Donner Summit. The principle involved (Lambert's Law) is that the intensity of radiation from a radio-active element, after passing through an absorbing medium (snow), depends upon the original intensity of radiation and the thickness of the absorbing medium. Because water sets up the same resistance whether frozen or not, the reading that is taken is not concerned with the depth of snow, but only with the amount of water it contains. The experiment, the first of its kind anywhere in the world, moved out of the laboratory and into the mountains above Pine Flat and Isabella Dam sites.

The system consisted of measuring the radiation through snow from radioactive cobalt buried in the ground (within a lead tube). Approximately fifteen feet directly above this, a radiation detector was placed to receive and then transmit the data, through a chain of relay stations, to the engineers who then decoded the electronic signals. The Sacramento District worked for years with the Philco Corporation to develop the equipment necessary for the program. The technical barriers of the project were overcome with the use of transistors, which could operate continuously from batteries and which use relatively little power.

From these efforts, the *profiling snow gauge* was developed — a device that records, in half-inch sections, the density of the pack from ground level to surface. Using isotopes, internal changes within the pack caused by wind, solar radiation and rain can be studied and translated into action that could eventually save lives and property.

The man responsible for much of the research and new knowledge gained about snow was Glenn H. Castle, a Sacramento District hydrologist. It was he that built and installed the first of the *Castle gauges* at the snow research laboratory in 1959. The first such gauge is still operating at the lab. The latest devices to be placed in the Sierra to keep tabs on snow conditions are "snow pillows." Designed to replace the radioactive devices, the new mechanism consists of a rubber pillow about twelve feet in diameter, which is filled with 400 gallons of denatured alcohol. The pillow is covered with wire netting and connected by hose to a riser pipe. The weight of the snow which accumulates on the pillow forces the fluid to rise in the pipe, in proportion to the weight of the water content of the snow. A float-operated telemark sends coded readings to receiving instruments at Isabella and Pine Flat Dam project offices.

Three snow pillows were first installed above Pine Flat Dam in the Kings River watershed during 1966. From information transmitted to Pine Flat, the engineers were able to determine almost precisely the amount of water in the snow, the rate at which it was melting, and how fast it would come rolling down the mountains. Because of this initial success, pillows were placed in the Kern River watershed during October 1967. The devices were designed to

THE SHERMAN MOUNTAIN RADIO RELAY ANTENNA IN THE KERN RIVER BASIN 30 MILES SOUTHWEST OF MOUNT WHITNEY. ELEVATION HERE IS 10,000 FEET. THIS ANTENNA RELAYS SNOW WATER CONTENT INFORMATION GATHERED FROM SNOW PILLOWS TO THE ISABELLA DAM RECEIVING STATION.
(Army Corps of Engineers Photo, 29 January 1969)

YOU'RE LOOKING AT THE SACRAMENTO RIVER ON THE LEFT AND THE SAN JOAQUIN ON THE RIGHT AND YOU'RE STANDING IN THE MIDDLE OF SUISUN BAY. WITH THIS DELTA ADDITION TO THE CORPS OF ENGINEERS' WORKING MODEL OF SAN FRANCISCO BAY, PROBLEMS OF POLLUTION, WATER QUALITY, NAVIGATION AND OTHER ITEMS CAN BE STUDIED FOR SOLUTIONS LEAST HARMFUL TO THE ENVIRONMENT.

U.S. CONGRESSMAN HAROLD T. (BIZZ) JOHNSON (L.) HAS JUST ACCEPTED A CROME-PLATED AND INSCRIBED SHOVEL SYMBOLIC OF THE CONSTRUCTION START OF THE BUCHANAN DAM FROM COLONEL JAMES C. DONOVAN, ARMY CORPS OF ENGINEERS. LOOKING ON (L. TO R.) ARE: MADERA COUNTY SUPERVISOR HAROLD J. BALMAT; JUDGE H.V. EASTMAN, SECRETARY-MANAGER, CHOWCHILLA WATER DISTRICT; AND CHOWCHILLA MAYOR SAMUEL L. McCLAUGHRY.
(Army Corps of Engineers Photo, 2 July 1971)

measure water content up to 300 percent of normal, or 150 percent of the maximum of record, which is about 80 inches of water. In March 1969, Mr. Castle expressed concern about the record snow pack covering the high Sierra at that time. The water content of the snow had already reached 70 inches. Castle stated, "About ten more inches and the weight of the water will force the alcohol out the top of the riser pipe and we'll have to unpack our snowshoes and back packs and measure like in the old days." Since their installation, the snow pillow information, when coupled with other essential data, has been of vital importance to those responsible for flood control.

Yet another unusual device is used by the Sacramento District in the design, construction and operation of flood control projects. Located at Sausalito is a scale model of San Francisco Bay and the Delta.

HIDDEN AND BUCHANAN DAMS AND RESERVOIRS UNDER CONSTRUCTION

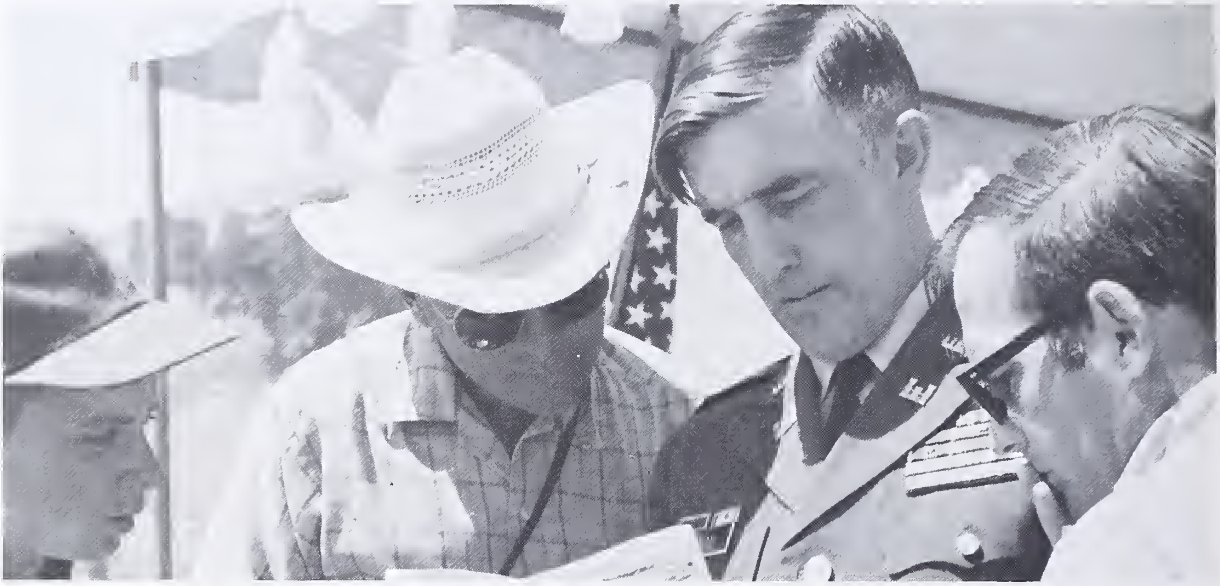
From high in the air above the great Central Valley of California, the San Joaquin River appears as a giant shepherd's crook. On the inside of this watery hook, the final products of a long and difficult struggle are being realized. Buchanan and Hidden Dams, though authorized by the Flood Control Act of 1962, have been desired, needed and studied in one form or another for many years. Almost a century ago, a private company tried to build a reservoir near the old ghost town of Buchanan. During the 1880s, the graves of the early settlers who came to the valley as a part of the gold rush were excavated from the bottom land along the Chowchilla River. Soon men and mules were sculpturing the hillsides in a futile attempt to put up a dam. Until bulldozers obliterated them, the old abutment excavations were still there.

The heritage of Hidden Dam also reaches back to those hazy days of a forgotten era. The dam itself sits almost on the very spot first settled in what has become Madera County. Here too, as they did at Folsom and other reservoirs, the engineers from Sacramento relocated the lonely graves of those who had made their homes, as early as 1850, near Hensley Bridge in the Fresno River country. It was here that Major John Hensley and Sam and Edward Dennis discovered gold. Others learned of the find and quickly staked out sections of the river's edge in hopes of striking it rich. Major Jim Savage supplied their needs from his trading post and made more from his mercantile venture than did most of the miners from their prospecting.

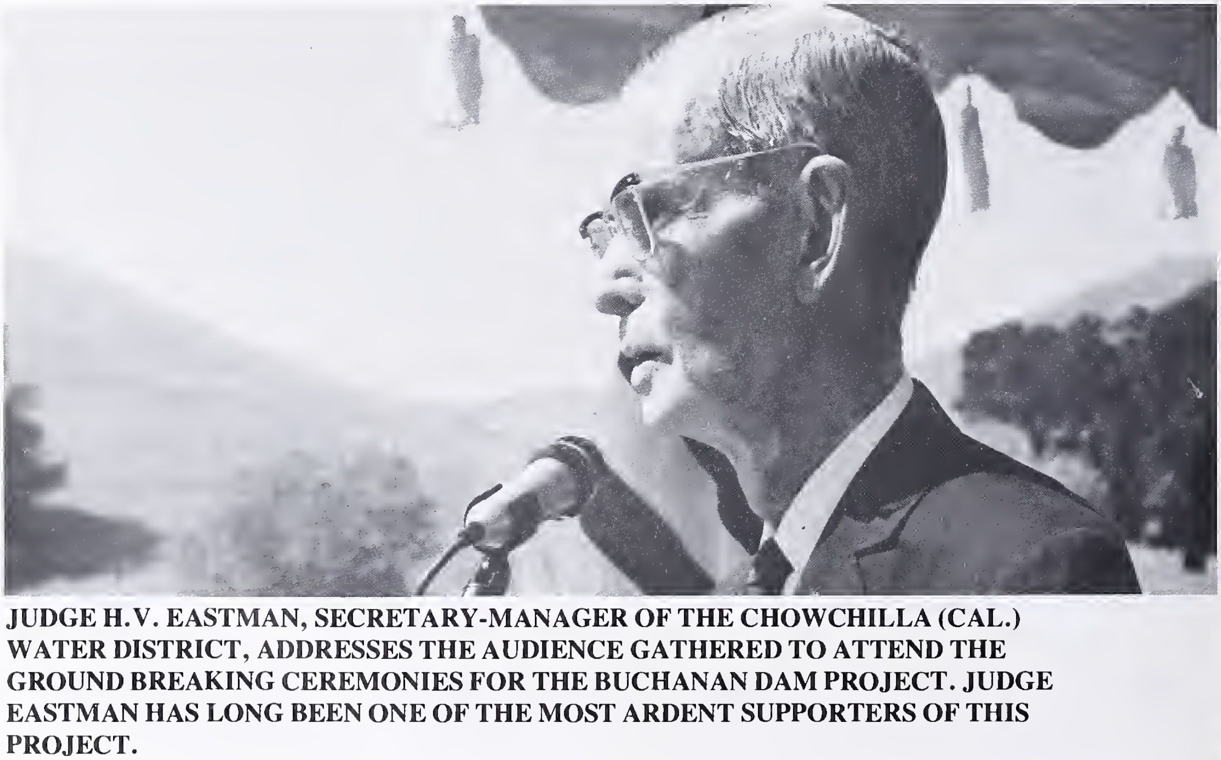
The first Corps of Engineers officer to traverse the region was John C. Fremont. Others came later to build forts and roads. Engineers from Sacramento have explored the area, in terms of flood control, since the late 1920s. Further surveys of the Fresno and Chowchilla rivers were carried out under the authorizations of the "308" studies and the 1936 Flood Control Act. Suspended because of the war and not funded for further study until the floods of 1955, the twin projects were finally authorized in 1962. The work was just about ready to go out to bid by 1966 but was shelved because of the lack of funds and low priority. Local people were not about to be put off again. They kept up their demands for flood control facilities on the rivers and in the end had their way.

Buchanan Dam was the first of the pair to receive attention. On 2 July 1971, a very warm Friday, the District Engineer, Colonel James C. Donovan, participated in ground breaking ceremonies for relocation of a road, the first physical construction for the project. Among the almost 200 who cheered as the first dirt was turned with the chrome-plated shovel were descendants of those early settlers who lived, toiled and found their final resting places in the bottom lands of the Chowchilla River region. Also taking part in the ceremonies were Congressman Harold "Bizz" Johnson; Harold Balmat, Madera County Supervisor; Judge H.V. Eastman, Secretary-Manager of the Chowchilla Water District, and several other dignitaries. In his address, Colonel Donovan detailed the benefits that would be forthcoming from the completed work. "Here's what we expect of the Buchanan proj-

FLOOD SCENES OF CHOWCHILLA COMMUNITY. NOVEMBER 19, 1950
(Photos – Wessel's Studio, Chowchilla, Calif.)



COLONEL JAMES C. DONOVAN, SACRAMENTO DISTRICT ENGINEER, U.S. ARMY CORPS OF ENGINEERS, RESPONDS TO QUESTIONS FROM A GROUP OF INTERESTED CITIZENS AT THE GROUND BREAKING CEREMONIES FOR THE BUCHANAN DAM PROJECT HELD JULY 2ND, 1971.
(Army Corps of Engineers Photo)



JUDGE H.V. EASTMAN, SECRETARY-MANAGER OF THE CHOWCHILLA (CAL.) WATER DISTRICT, ADDRESSES THE AUDIENCE GATHERED TO ATTEND THE GROUND BREAKING CEREMONIES FOR THE BUCHANAN DAM PROJECT. JUDGE EASTMAN HAS LONG BEEN ONE OF THE MOST ARDENT SUPPORTERS OF THIS PROJECT.
(Army Corps of Engineers Photo)

BUCHANAN DAMSITE — 22 SEPTEMBER 1970

ect. It will provide flood protection to city and farm areas downstream from the lake, including Chowchilla. If the dam had been in place during the January 1969 flood, more than one million dollars in damages would have been prevented."

In addition to its flood control capability, the dam and reservoir will achieve other important goals. Colonel Donovan pointed out that, "This project will also make available a new irrigation supply averaging 24,000 acre-feet of water per year. It will provide recreation areas with boat launching ramps and camping and picnic sites. The upper reaches of the lake will be devoted to improving the habitat for the abundant deer and quail in the area."

The flood fighting capability of the dam and reservoir is being supplemented by downstream channel improvements. The main channel and adjoining sloughs are being cleared and leveed for this purpose. Moreover, local interests will be required to pay for irrigation service, which will be financially integrated into the Central Valley Project of the U.S. Bureau of Reclamation. It is expected the entire project will be completed by mid-1975. On 3 May 1972, before a standing room only crowd, it was announced that the Perini Corporation of San Francisco was the low bidder for *both* construction jobs. At about the same time, Colonel Donovan appointed Louis Gerdin as resident engineer and Captain Robert Mentell as his assistant on both projects.

Just a month and a half later, on 24 June 1972, Colonel Donovan helped launch the construction of Hidden Dam at ceremonies held a few miles south of the little town of Raymond. The Fresno River has more than once spilled out of its channel and flooded the City of Madera. Speaking on this topic, the District Engineer expressed his delight in seeing a dam built to prevent floods, "instead of trying to rescue people off the tops of their houses." When completed, the dam, reservoir and channel improvements will provide a substantial degree of protection from floods to the City of Madera and the suburban, industrial and agricultural areas along the Fresno River. If a major flood should occur, it is estimated that the project will prevent damages of some $15,300,000. At the same time Hidden Lake will make 23,800 acre-feet of water available for irrigation annually, and afford substantial recreation and fish and wildlife opportunities.

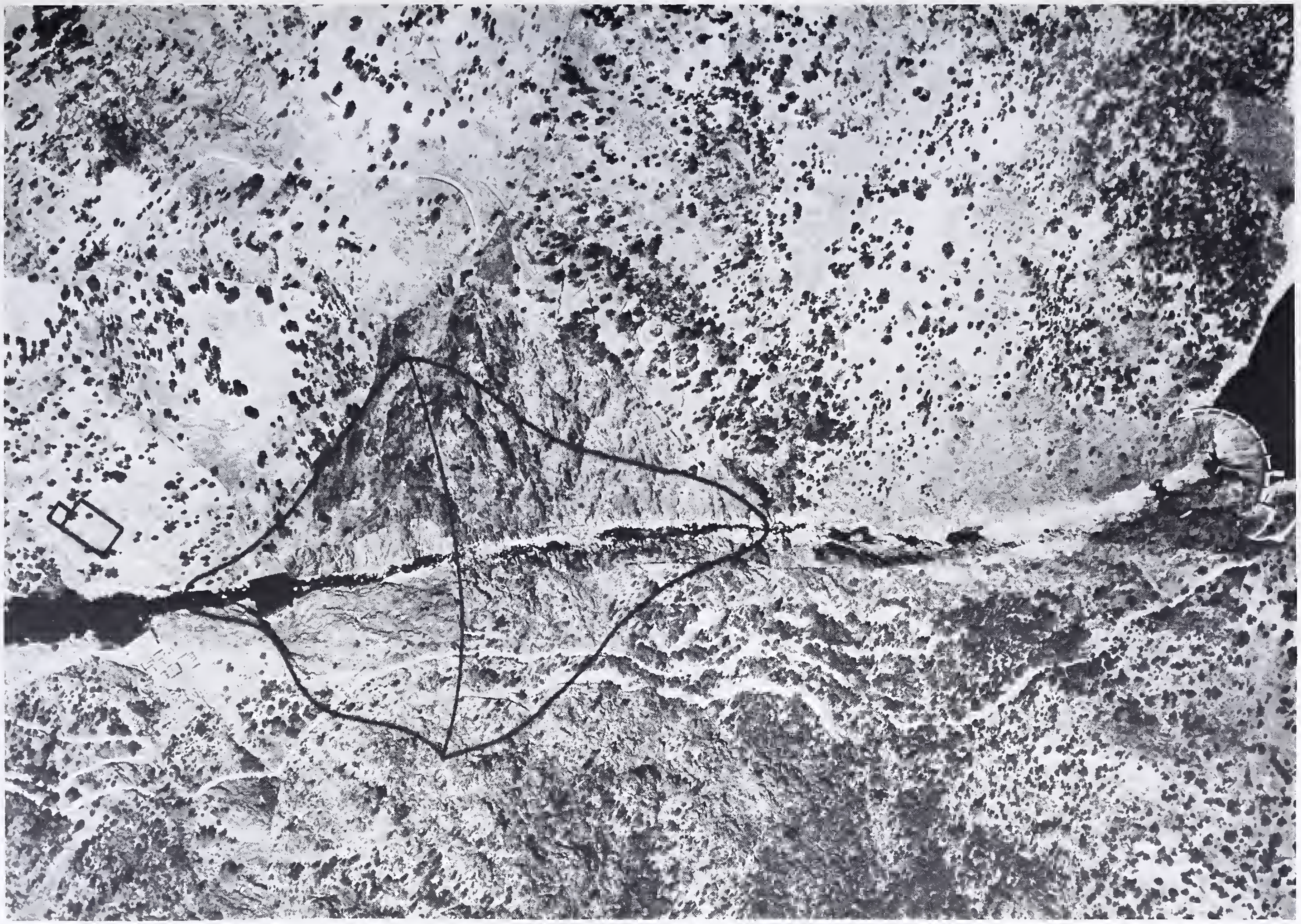
Statistically, Buchanan Dam will be a rockfill barrier 205.5 feet high and 1,800 feet long (crest length). Its reservoir will have a gross capacity of 150,000 acre-feet. The project is located about sixteen miles northeast of Chowchilla. Hidden Dam will be an earthfill barrier 163 feet high and will have a crest length of 5,730 feet. Its reservoir will have a gross capacity of 90,000 acre-feet. Hidden Dam and Lake will be located about fifteen miles northeast of Madera.

NEW MELONES

In the very heart of the Mother Lode country, the Sacramento District is building one of the largest earthfil dams in the world: New Melones Dam. No area in the West is richer in folklore and genuine history than the foothill area lying between the towns of Angels Camp and Sonora. The river that bisects the tract was named for a mission-educated Indian chief who took the name Stanislaus, after a Polish saint. The New Melones Dam takes its name from the Spanish word for melon. Soon after Marshall made his historic find near Sutter's mill, Mexican miners found placer gold along the Stanislaus and its tributaries. Working the streams, they found gold nuggets shaped like melon seeds, which they would trade for supplies in the nearby camps and towns. Before long, the whole district was known as Melones, the place from which the melon seed gold comes. The little mining town of Melones, founded by these same Mexican miners in 1848, got its name from the same source. Presently the town is a shambles of shacks and worn-out mining equipment hiding in the lush green grass and golden California poppies of a Sierra spring.

The broken and rusty appliances are silent reminders of that long-ago time when the Melones-Carson Hill mining district was the most colorful and exciting in the state. Those were the days when the Billy Mulligan gang

NEW MELONES (ARTIST'S CONCEPT)
(Army Corps of Engineers Photo)



MELONES DAM (RIGHT CENTER) AND POWERHOUSE (LEFT CENTER, LEFT ABUTMENT) ARE SHOWN IN THIS AERIAL TAKEN IN DECEMBER 1955. OUTLINED IN BLACK ARE THE PROPOSED NEW MELONES DAM AND THE NEW POWERHOUSE WHICH WILL BE BUILT ACROSS THE STANISLAUS RIVER OPPOSITE THE OLD ONE. *(Army Corps of Engineers Photo).*

RUGGED CANYON WALLS AND RUGGED MEN MATCH THEIR STRENGTH AT THE NEW MELONES DAM PROJECT NEAR SONORA, CALIFORNIA. THE SACRAMENTO DISTRICT, US ARMY CORPS OF ENGINEERS, IS BUILDING THE DAM WHICH WILL BACK UP WATER FOR 26 MILES, INUNDATE THE OLD DAM, CREATE A SHORELINE OF OVER 100 MILES AND FORM A RESERVOIR POOL OF 2.4 MILLION ACRE-FEET. AN ACRE-FOOT OF WATER IS 325,851 GALLONS. THE DAM WILL RISE 625 FEET ABOVE THE STANISLAUS RIVER AND SPAN 1550 FEET OF IRON CANYON. AN OVERLOOK FOR THE CONVENIENCE OF PUBLIC VIEWING IS OPEN EVERY DAY AT THE DAMSITE. *(Army Corps of Engineers Photo)*

jumped the claims of Jim Carson and John Hance. The Mulligan boys held the mines for nine months before the sheriff got them to leave. About a year later, the biggest mass of gold ever produced in California was taken from Carson Hill. It weight 195 pounds troy, which, calculated at today's (1973) prices, would be worth about $100,000.

This is also the same area where Mark Twain shared a cabin with the Gillis brothers who worked some of the famous "pocket" gold mines on Jackass Hill. On the northwest slope of Jackass Hill, and a short distance from the restored Mark Twain cabin, is the Norwegian mine. This gold mine gained fame when the notorious outlaw Black Bart was caught as a result of a fracas involving a stagecoach carrying gold from the mine. Supposedly, he dropped his bandana while holding up the stage. Later it was used to trace him to San Francisco where he was arrested.

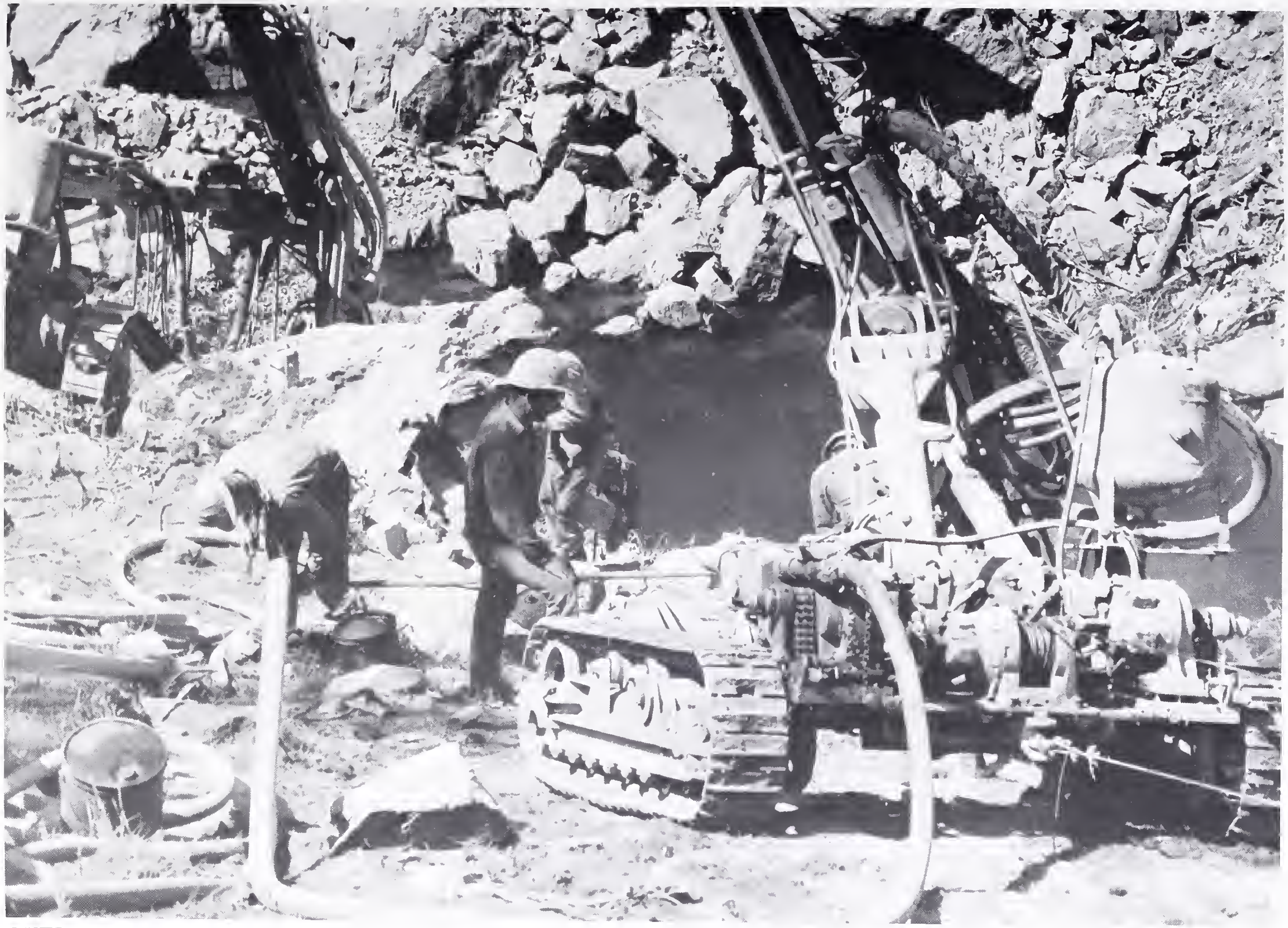
To preserve, in a small way at least, the history, and perhaps a bit of the flavor of the area, the South San Joaquin and Oakdale Irrigation Districts named their dam on the Stanislaus River, Melones. The Sacramento District began planning flood control works on the Stanislaus as part of the "308" studies. Little further work was accomplished until the summer of 1937 when additional study was done under the authorization of the Flood Control Act of 1936. Finally, the project was authorized in the massive Flood Control Act of 1944 and then modified by the 1962 Act. As presently designated it will be the second highest earthfill dam in the United States. It is also the largest and most expensive single project yet to be undertaken by the Sacramento District. The Corps, in a concession to history, has in like manner named its facility New Melones.

Under the direction of Colonels Turner and Mathe, District Engineers, Sacramento personnel began preliminary site-investigations during the early and mid-sixties. By the fall of 1966, they were evaluating data obtained from the four long adits (tunnels) that had been dug into the mountain to determine the stability of the interior rock formation. A year later, scaling operations on the steep sides of Iron Canyon were begun. This was a pretty tricky business. To begin with, Justin Moses and Harry Barz, both District employees, had to utilize mountain climbing techniques and equipment to suspend themselves next to the sheer mountain sides so that they could mark the unsafe areas. By the spring of 1968, the scaling work, largest operation of this type in California's history, had reached the half-way point. So that one may appreciate the danger and magnitude of this phase of the project, let us borrow from the District Information Bulletin of 5 April 1968:

> Muscle, machines and powder have bared the north wall of Iron Canyon . . . Scalers in bosun chairs hang precariously from life-saving ropes on the sheer 600 foot high wall while bulldozers appear to be glued to the near vertical cliffs. Jackhammers rip into the rock and powdermen gingerly place explosives for detonation.
>
> By night the canyon of the Stanislaus River echoes to the call of the coyote. By day the shrill shriek of the hawk is lost to the diesel engine, the air compressor, the airtrack drill, and the voice of man . . . the dozer's tight switch-backs . . . appear to be shoe laces holding the canyon's sides together.
>
> A balancing, fissured outcropping tumbles, gathering other rocks with it in a 400-foot plunge to the riverbed. Dust rises with the canyon wind, obliterating the blue sky. Old Melones Dam upstream is curtained.
>
> No matter where any one of the 50-man Morrison-Knudsen crew works, safety is the watchword. Thirty men of the work force have received Red Cross safety training.
>
> The sure-footed men of the hand-scaling crew move gracefully along the wall with uncanny skill. Carrying drill bits, jackhammers, safety ropes, and compressor hose, these men move as much by a sense of feel as by sight.
>
> A loose rock, a sprained ankle, sudden ac-

THE OLD POWERHOUSE WILL REMAIN WHEN THE NEW MELONES DAM RISES WHERE THE RIFFLES ARE APPARENT IN THE STANISLAUS RIVER NEAR SONORA, CALIFORNIA. THE EARTHFILL DAM WILL BE BUILT UNDER THE SUPERVISION OF THE SACRAMENTO DISTRICT, CORPS OF ENGINEERS. IT WILL RISE SOME 625 FEET FROM THE STREAM BED AND SPAN ABOUT 1550 FEET OF THE CANYON.
(Army Corps of Engineers Photo)

A POWDER MONKEY TAKES A BREATHER DURING A HARD DAY'S WORK AT THE NEW MELONES DAMSITE.
(Army Corps of Engineers Photo)



OUTLET (DOWNSTREAM) PORTAL OF THE DIVERSION TUNNEL UNDER CONSTRUCTION AT NEW MELONES DAM PROJECT. THIS TUNNEL WILL DIVERT STANISLAUS RIVER WATER AROUND THE DAM CONSTRUCTION SITE.
(Army Corps of Engineers Photo)

rophobia, and imbalance are all hazards of the scaler's trade. He works by unwritten rules inherent in the job and is a member of an exclusive team.

Sharing this prestige position are bulldozer operators who in handling their equipment along the edge of the precipice are considered to be the best in the business. On near vertical slopes, a "yo-yo" system is used with a cable attached to the bulldozer and an uphill winch offering some assistance.

During the summer of 1970, work was begun on the huge twenty-six million dollar diversion and multipurpose tunnel. The work was completed by November 1973. Generally, work at the dam site proceeded quite well during the initial stages of construction, but during the week of 17 March 1972, in an almost unprecedented action involving federal projects under construction, the District Engineer, Colonel Donovan, announced that he would not call for bids until late in the summer so that District personnel could complete additional environmental studies of the area. Originally, bid invitations for the main dam were to be issued on 15 March 1972. To explain his action, Colonel Donovan stated, "The New Melones project is unique in that it has been under construction since 1966 when we were not required to submit an Environmental Impact Statement. Times have changed, and I want to assure myself and the public that this District has done everything possible to comply with new policies and laws regarding the environment even though we are not legally required to do so."

Earlier, the Colonel had prepared a draft EIS and sent it to all interested groups and agencies. By March some had replied, but not all. The District Engineer felt that "until these comments are received and our responses prepared, the final report cannot be completed."

Among the first to submit remarks to the District were white-water boating enthusiasts, Sierra Clubbers and members of the Environmental Defense Fund. In the main, they were concerned with the elimination of a rapids area due to the lake filling and covering this reach of the river upstream from the dam site. In response to this concern, the District, in cooperation with the South San Joaquin and Oakdale Irrigation Districts, undertook a rather unique experiment. On 20 May 1972, 350 acre-feet of water was released from Goodwin Dam on the Stanislaus River to examine the feasibility of creating a four mile white water kayak run downstream from New Melones. (The 14,047,850 gallons of water was sent splashing down the near-dry canyon as part of the search to discover a substitute for the loss of several miles of rapids then being used by commercial rafting companies and kayakists.) In regards to this effort, Colonel Donovan remarked, "We are exhausting every possibility in our search for an alternative satisfactory to environmental, recreational, and boating interests."

Late in May, final review of the extensive environmental impact statement was being completed. To supplement this lengthy document, Colonel Donovan, using some seventy slide photographs, briefed representatives of the valley's leading newspapers. Throughout his comprehensive presentation, the Colonel emphasized the environmental benefits which the public would enjoy as a result of the dam and lake. Examples of these are increased salmon and steelhead runs, canoeing, swimming, camping, cave exploring and just plain relaxing along the lake's 100-mile shoreline. In appearances on major network television newscasts, he again told of the special as well as the traditional benefits of the multi-use project. In defense of the value of the work, he said, "We pursued every environmental question, seeking alternatives. I feel very keenly about the loss of a few miles of beautiful white water upstream, but in the final consideration this loss is far outweighed by other benefits to a much greater number of people."

It has been estimated that about 20,000 visitor days accrue because of white water river running. After the completion of the dam, it is expected that millions of recreationists will use the lake and campgrounds.

The Environmental Defense Fund filed suit against the project on 8 June 1972, seeking in-

LEFT TO RIGHT ARE RESIDENT ENGINEER JOE NELSON, COLONEL JAMES C. DONOVAN, SACRAMENTO DISTRICT ENGINEER, US ARMY CORPS OF ENGINEERS, AND CONGRESSMAN HAROLD T. (BIZZ) JOHNSON, (D., CAL.), INSPECTING THE DIVERSION TUNNEL UNDER CONSTRUCTION AT THE CORPS' NEW MELONES DAM PROJECT ON THE STANISLAUS RIVER.
(Army Corps of Engineers Photo, 11 January 1971)

junctive and declaratory relief. During the week of 21 July 1972, the New Melones Environmental Impact Statement reached the Council on Environmental Quality after moving through administration channels since the previous March. After considerable study, the Court found in favor of the Corps. Almost immediately, the EDF sought to stop project by filing with the appellate court, the Ninth Circuit Court of Appeals. This is what the situation is at present (Fall, 1973).

Litigation notwithstanding, the District was given the go-ahead to call for bids. The situation remained touch and go throughout the summer and fall of 1972, but finally on Tuesday, October 10th, at two o'clock in the afternoon, bids for the main dam were opened. In the crowded and tense atmosphere, television lights adding to the heat of the throng, Michael Bakarich announced that the bid of $83,245,082, submitted by the joint venture of Guy F. Atkinson and Dravo Corporation, was lowest of the five tendered. Part of the tenseness of the occasion can no doubt be attributed to the fact that Judge Charles B. Renfrew had listened to arguments by counsel as late as 6:00 P.M. the prior day. The judge decided to permit the opening of bids, providing the actual contract award not be made prior to 1 December 1972, and physical construction not be initiated prior to 5 March 1973.

(Actual award of a contract to Atkinson-Dravo was never made because that firm, after repeatedly extending the date for acceptance, finally withdrew its bid in October 1973 because of economic and other conditions beyond its control. Ironically, only a few weeks later the Court of Appeals upheld the ruling of the lower court and ruled that construction could proceed.)

Many critics, both engineers and environmentalists, believe the Sacramento District's Environmental Impact Statement concerning New Melones is the most thorough document of its kind yet written. Even so, the District prepared additional data to support its position. Primarily, the supplemental study deals with the utilization of irrigation water in various service areas and how this utilization will affect the environment.

The Public Affairs Office of the District, in July 1972, prepared as the sole item of its *Information Bulletin* an excellent summary of the EIS that was submitted to the Council on Environmental Quality. The following is a quotation from that summary:

NEW MELONES ON BALANCE

Whatever else may be said of the U.S. Army Corps of Engineers, it has rarely if ever been accused of professional incompetence, never of dishonesty. In the case of the New Melones Dam and Lake Project, it has exceeded even its own high standards for thoroughness. It has painstakingly investigated every aspect of environmental detriment that has come to light, and continues to do so. Wherever possible, it has sought to ameliorate those losses which are the inevitable by-product of such a major water development.

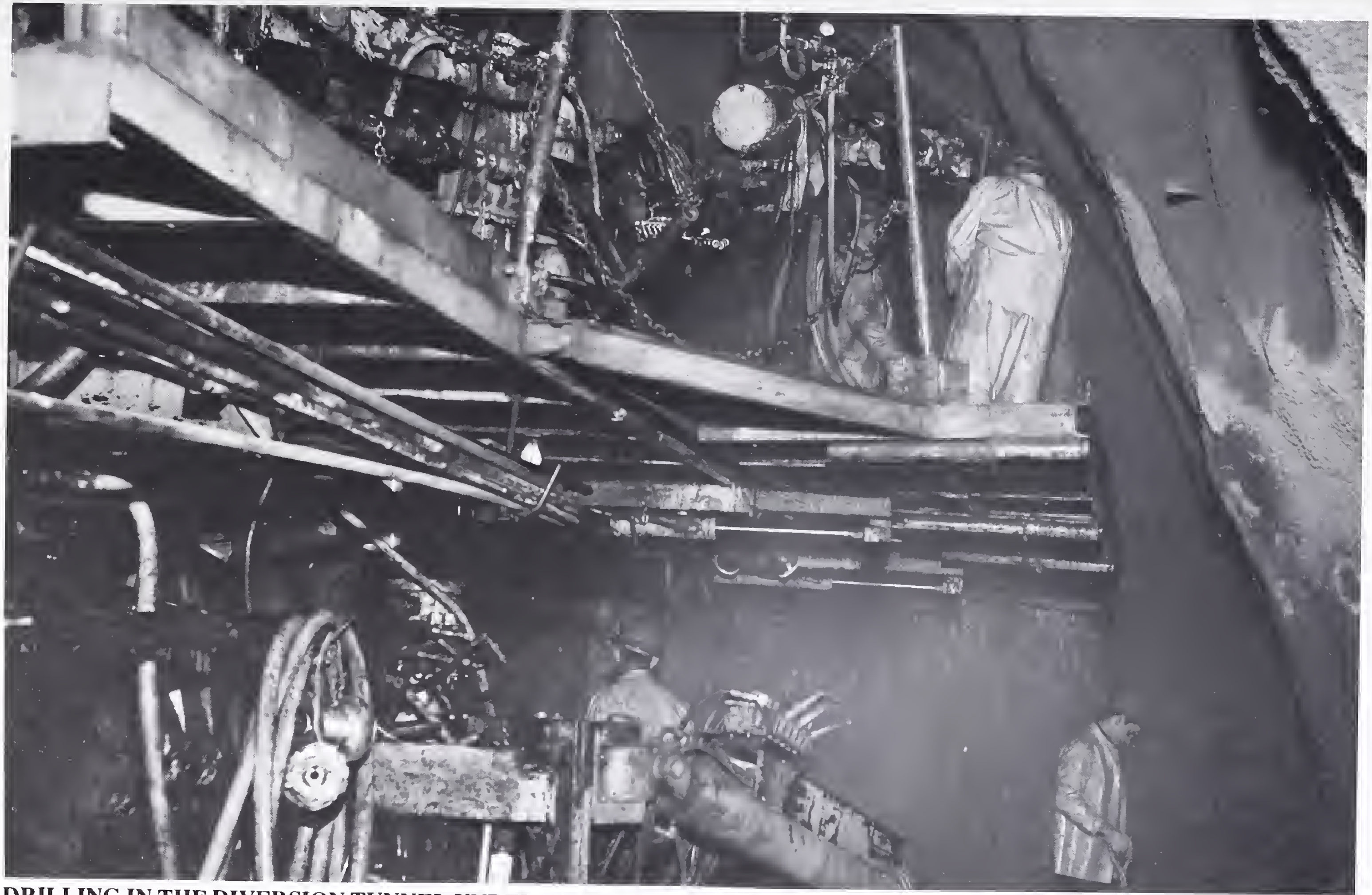
Lest it be implied, because of the emphasis on certain environmental losses, that the proposed project brings nothing but environmental havoc which must be mitigated, let the reader be assured the project's net benefits are substantial.

Gains and losses are outlined briefly in the following summary; a comprehensive explanation of both may be found in the Environmental Impact Statement prepared on this subject by the Sacramento District.

Consideration of all the evidence at hand has led the Corps to the conclusion that the environmental benefits of the New Melones project will exceed the environmental losses. What's more, the project will provide a variety of other benefits.

FLOOD PROTECTION

Principal among these is the flood protection the project will afford some 35,000 acres of high developed agricultural land along Stanislaus River. Together with other projects on the lower San Joaquin and Tuolumne Rivers, it will aid materi-



DRILLING IN THE DIVERSION TUNNEL UNDER CONSTRUCTION AT THE NEW MELONES DAM PROJECT IS DONE BY NINE AIR DRILLS MOUNTED ON A RUBBER-TIRED "JUMBO". AFTER THE HOLES ARE DRILLED IN THE TUNNEL FACE, THE JUMBO DRILL BACKS OUT OF THE TUNNEL, CHARGES ARE PLACED AND SET OFF, AND THEN THE "MUCKING", OR CLEARING, OPERATION IS PERFORMED BY TWO RUBBER-TIRED FRONT-END LOADERS.
(Army Corps of Engineers Photo, 4 March 1971)

ally in reducing flood stages along the lower San Joaquin River and in the Delta. This, in turn, assists in protecting 235,000 acres of intensively developed agricultural lands, military installations, and industrial and suburban areas near Stockton.

The project will also provide a new irrigation supply of nearly 93 billion gallons a year to relieve present deficiencies and provide water to presently undeveloped lands.

OTHER BENEFITS

Its hydroelectric power plant will provide an annual increase of about 430 million kilowatt-hours of usable energy, enough to satisfy the electrical needs of a city of 70,000 people. Such clean power has the added benefit of probably eliminating the need for construction of equivalent capacity in a fossil-fueled powerplant.

OPERATIONAL RESPONSIBILITIES

The New Melones Project, when completed, will be turned over to the Bureau of Reclamation for operation and maintenance and integration into the Central Valley Project (CVP). The Bureau will use the new water developed by the project in one or more of the following ways: (a) to serve the existing irrigation districts along the Stanislaus River, (b) to serve areas both north and south of the drainage of the Stanislaus, (c) to serve the southern San Joaquin Valley via the as-yet unbuilt East Side Canal, or, finally, (d) to satisfy water quality requirements in the Sacramento-San Joaquin Delta. The Dept. of the Interior has the authority from Congress to explore all aspects of water supply use from the lake. A full evaluation of these aspects, to include the environmental effects in the several areas of water needs, will be made prior to initiating operation of the completed project.

FINE COOPERATION

The Environmental Impact Statement explains fully the points contained in this summary. The closest cooperation has been achieved with environmental groups in the consideration of those aspects of the project. The two local Sierra Club groups (Yokut Wilderness Group in Modesto, and Mother Lode Chapter in Sacramento), working closely and harmoniously with the Corps, have withdrawn their earlier objections to the project although they have noted the loss of the whitewater boating area and urged that every effort be made toward full mitigation. They have expressed their belief that no additional irrigation water is needed in the southern San Joaquin Valley and have suggested that the conserved water supply from the New Melones Project be used to improve water quality in the Sacramento-San Joaquin Delta.

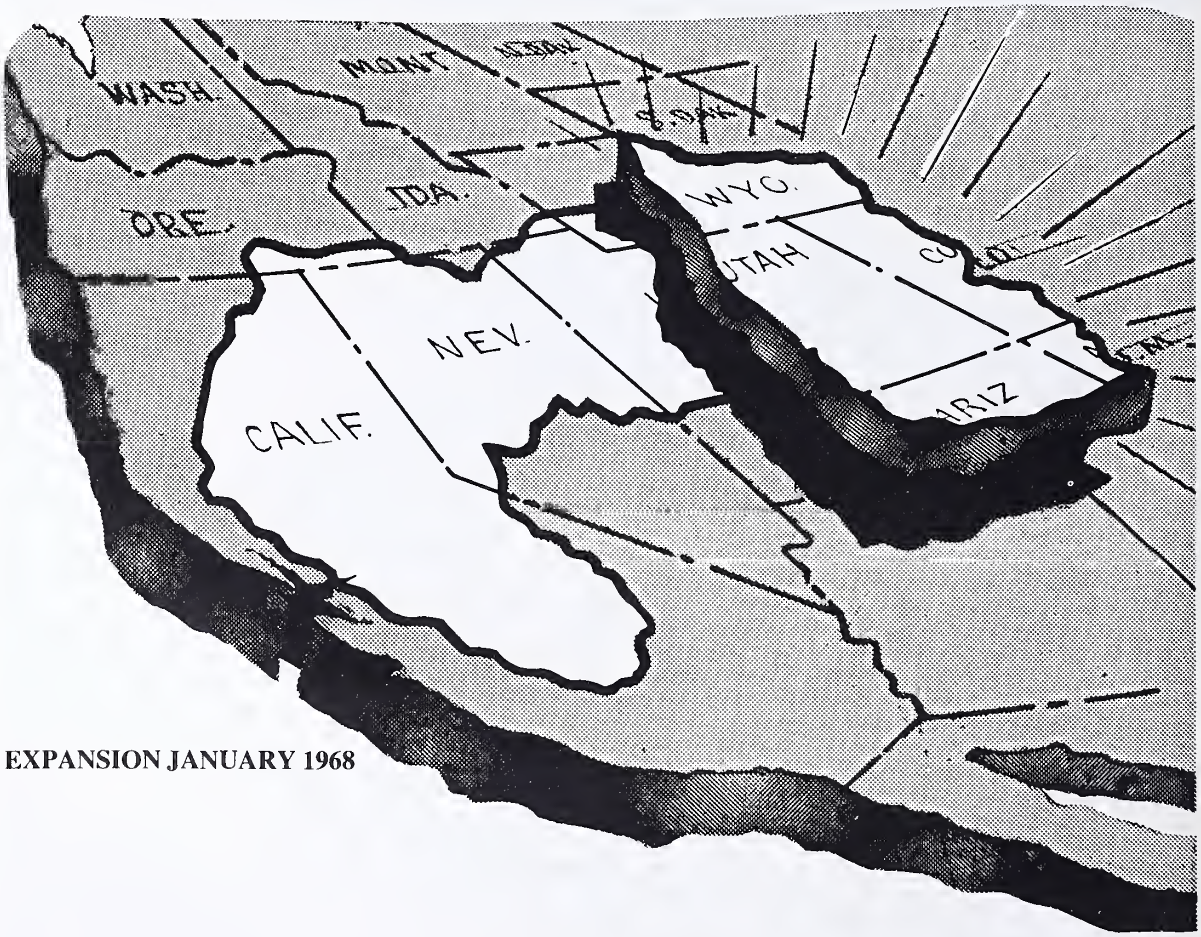
In summary, the Corps of Engineers, as a consequence of its exhaustive studies of the project, has determined that it should be completed expeditiously and the benefits therefrom, both environmental and economic, be made available to the public at the earliest time.

No one can foretell when the next major flood will occur, but it is known that, had the project been finished prior to the Christmas flood of 1955, almost two million dollars in damages would have been prevented along the Stanislaus downstream from the existing dam. Another $1,600,000 in damages was suffered in the December 1964 flood. In 1967 the completed work would have prevented some three-quarters of a million dollars in flood damages. It is estimated that should a major flood come roaring out of the mountains south of Stockton some $4,400,000 worth of devastation will be prevented.

New Melones, of course, is not an isolated project designed to work independently of other similar facilities. On the contrary, when completed it will act in unison with its foothill partners to protect and serve the valley and the

COLONEL CRAWFORD YOUNG — SACRAMENTO DISTRICT ENGINEER — JUNE 1966 — DECEMBER 1968

people who live there. Working in conjunction with projects on the Tuolumne and lower San Joaquin Rivers, New Melones will help prevent an estimated $46 million in damages along the lower San Joaquin River and in the Delta. It is not terribly difficult to measure damage to land, homes, factories and roadways; not so with human suffering.



EXPANSION JANUARY 1968

CHAPTER IX
EAST OF THE SIERRA

In January 1968, the Sacramento District became the second largest district in the contiguous United States when about 104,000 square miles of territory was transferred from the Los Angeles District. All of Utah, except the southwest corner, Colorado, from the continental divide west, the southwest corner of Wyoming, the northeast corner of Arizona and northwest corner of New Mexico became a part of the Sacramento District. At the time of the reorganization, General John Dillard, South Pacific Division Engineer, pointed out that, "It has become evermore evident that development here in the West offers new opportunities and challenges to engineering organizations working in the public interest."

Colonel Crawford Young, Sacramento District Engineer, commenting on the increased responsibilities, stated that, "We are going to become more and more active in Utah, Colorado and Wyoming, and as we do we will adjust to the increase in direct proportion to the needs."

GREAT BASIN

The Great Basin is an elevated, 188,000 square mile arid mountain region between the Sierra Nevada Mountains on the west and the Wasatch Mountains on the east. The area includes most of Nevada and parts of Utah, Idaho and Wyoming. The chief rivers of the Great Basin include the Truckee, Carson, Walker, Humboldt, Sevier, Jordan and the Weber. Having no outlet to the sea, the rivers either drain into Pyramid Lake in Nevada, or the Great Salt Lake, in Utah, disappear into "sinks," or are completely used up for irrigation purposes.

The first Corps of Engineers officer to be active in the Great Basin, the area between the Rockies and the Sierras, was John C. Fremont. Lewis and Clark had crossed the northern reaches of the area during 1805 and 1806, but it was the "Pathfinder", in the company of mountain men, soldiers and scientists, who explored, studied and publicized the region. The first to permanently settle the area were the Mormons under the brilliant leadership of Brigham Young.

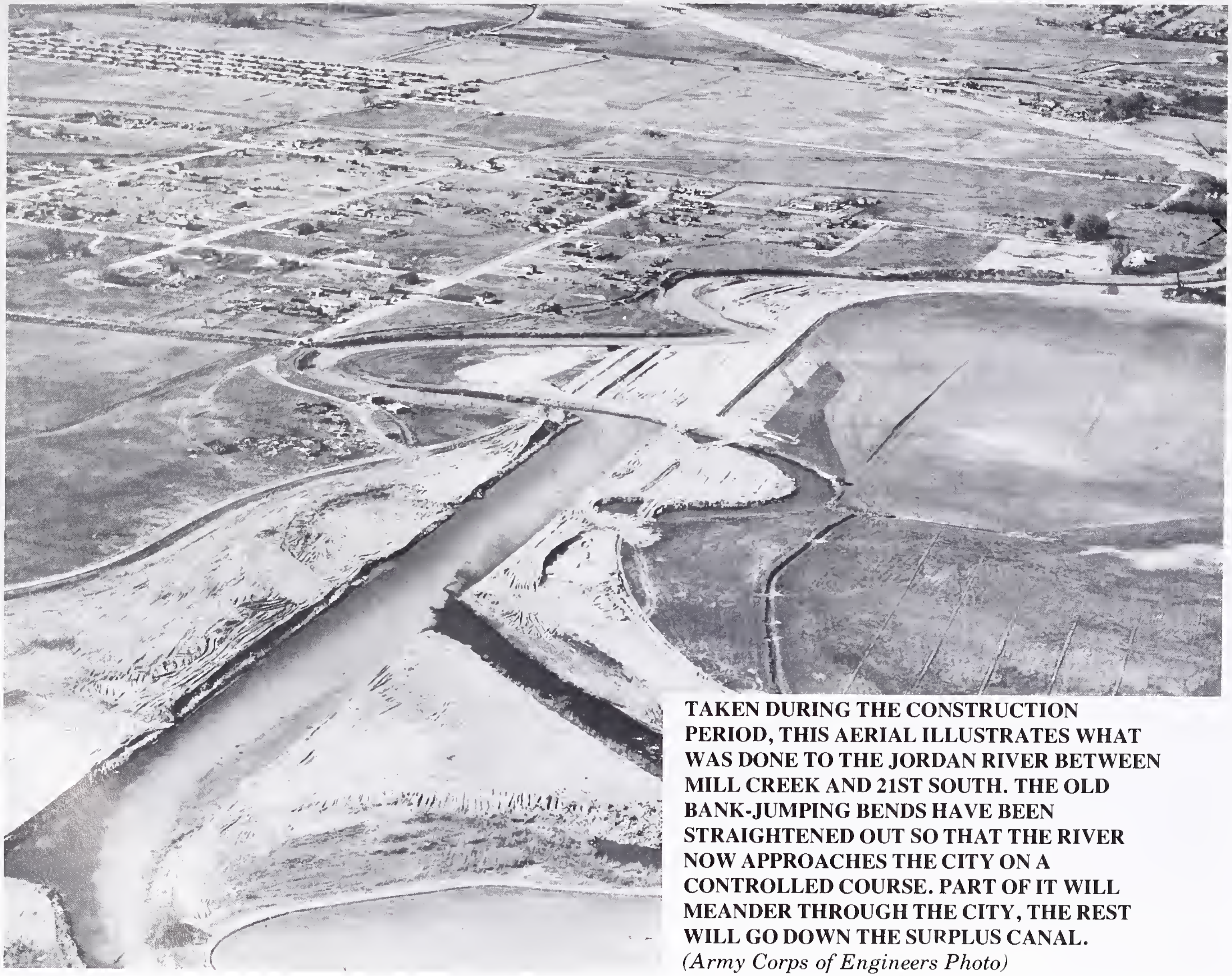
During the 1850s, Corps of Engineers officers completed surveys for the transcontinental railroad. After the Civil War, Corps of Engineers survey parties endured the hostile climate of the region for 10 years to complete a series of topographical and geographical surveys and explorations west of the 100th meridian. The hazardous work was carried forward so, ". . . That the physical structures of the waste and unknown lands along the untenanted mountain frontiers shall be brought to light and made known not only for the uses of the Government, but for all of the people and for all time." Through the efforts of these engineering officers, a wealth of previously unknown information was added to the bank of knowledge about the vast intermountain frontier.

Much later, during the Second World War, the intermountain region played a significant role, especially for the training of pilots, repair of aircraft, and storing of war materiel. In addition, it served as the temporary home for thousands of Japanese-Americans sent there from the coast. Cattle from its huge ranches, food from its farms and precious minerals from its mines all aided the war effort.

Typical of the early civil works projects undertaken by the Corps in the Great Basin is the flood control work along the Sevier River, south of Great Salt Lake. In the southwest corner of Utah, surrounded by high plateaus and even higher mountains, the Sevier River follows a horseshoe path of hundreds of miles and ends up nourishing the fields along its banks. It has been referred to as the "most used river in the world" because, except in the times of floods, every drop of water is diverted and put into fields until it's all used up.

This ideal arrangement was interrupted by the natural laws that govern the behavior of all streams. The pioneer farmers, by diverting the water into irrigation canals and ditches by means of fixed barriers, caused the river to slow down and drop much of its silt load. Ranchers further aggravated the situation by grazing their cattle on the upper watershed, which tended to increase the volume of silt being carried into the river. In time, the bed of the Sevier had raised to the point where, in the

GUNNISON-FAYETTE DIVERSION STRUCTURE, SEVIER RIVER.



TAKEN DURING THE CONSTRUCTION PERIOD, THIS AERIAL ILLUSTRATES WHAT WAS DONE TO THE JORDAN RIVER BETWEEN MILL CREEK AND 21ST SOUTH. THE OLD BANK-JUMPING BENDS HAVE BEEN STRAIGHTENED OUT SO THAT THE RIVER NOW APPROACHES THE CITY ON A CONTROLLED COURSE. PART OF IT WILL MEANDER THROUGH THE CITY, THE REST WILL GO DOWN THE SURPLUS CANAL.
(Army Corps of Engineers Photo)

worst stretches, it was soaking the valley instead of draining it. Thereafter, even minor floods put the stream over its bank and onto the fields. Instead of planting row crops, the farmers used their fields for pastures. Eventually, the pastures became swamps. A Corps of Engineers study of the problem revealed that:

> "...The streambed has been raised by sedimentation to the extent that minor floods inundate extensive areas of concentrated property values and local subsurface drainage has been so impaired as to necessitate progressive abandonment of contiguous crop land."

Town people, especially in the Redmond area, were also suffering because of the worsening situation. Their basements were filling with water. The extensive tile drainage system, installed by the City of Redmond in 1922, in the sterile language of an official report, became "largely ineffective." A conservative statement indeed, when one considers the fact that the river often rose higher than the outlets.

The passage of the Flood Control Act of 1936 offered the residents of the Sevier River Valley a way out of their predicament. They brought the problem to the attention of Congress which, in turn, directed the Corps of Engineers to study and report on flood control aspects of the situation. During the late thirties, the Engineers accomplished their charge, but had to wait until the war was over before they could begin corrective work.

Authorized in the Flood Control Act of 1944, the improvement was studied further in 1946 and 1947. After meeting with local interests, a final plan was developed and work began in the summer of 1948. The majority of the work consisted of excavating the river bed so the Sevier would drain adjacent lands. New depths varied from two and a half to eight and a half feet below the former grade. Some 1,500,000 cubic yards of accumulated muck was removed to provide a new channel with a bottom width of thirty-three feet, with a depth of between twelve and fifteen feet below the natural ground line. The excavated material was used to form continuous, uncompacted levees, which solved the problem of what to do with the dirt, while providing an added measure of protection. At the same time, a pair of obstructive diversion dams were replaced by radial gated structures that raise the water level only when needed for irrigation. Now, when there is no demand for irrigation water, the gates are opened so that the river can flush itself out.

The work was completed in the spring of 1951 at a cost of $19 million and has been operated and maintained by local interests since that time.

Moving north towards Salt Lake City, one comes upon three projects authorized by the Flood Control Act of 1946. The first, near the town of Spanish Fork near Utah Lake, when and if completed, will provide flood control along the lower thirteen miles of the Spanish Fork River. This will be accomplished by enlarging the channel and the construction of a levee on the right bank of the river at the town of Spanish Fork.

Preconstruction planning was begun in 1955 but discontinued because of lack of interest by the local residents. Actually, much of the flood problem in the area was alleviated by the emergency work completed following the spring floods of 1952. There being no demand for further work, the project has been classified "Deferred."

About twenty-five miles southwest of Salt Lake City, near the town of Magna, is a stream called Little Valley Wash. The Corps of Engineers was authorized in 1946 to construct a channel that would extend the wash a little more than a mile so that it would empty into an existing debris basin. When and if completed, the project would afford flood protection to the town of Magna, Utah. No desire for its completion has been voiced by local residents; hence, the project has been classified "Inactive." No work has been done to date.

The third project in the area, authorized in 1946, is the Jordan River improvement. Once the planning was completed and public meetings held with local residents, work was initiated in January 1959. The work included (1) increasing the channel capacity of the Jordan River by excavation and levee construction, (2)

LEVEE CONSTRUCTION AND CHANNEL IMPROVEMENT, JORDAN RIVER, SALT LAKE CITY, UTAH. SURPLUS CANAL REALIGNMENT AND NEW RAILROAD BRIDGE ON U.P. RAILROAD LINE, LOOKING SOUTHEAST. APRIL 1960
(Army Corps of Engineers Photo)

modifying the existing structure at the head of Surplus Canal, (3) the enlargement of Surplus Canal by excavation and levee construction, (4) modification of railroad and street bridges, and (5) modification of an irrigation diversion.

By diverting the excess flows of the Jordan River to the Great Salt Lake, the project protects the western portion of Salt Lake City and the nearby suburbs. Altogether, about 5,800 acres of residential, industrial, and commercial property is kept dry because of the million dollar plus improvement. Levee and channel work was completed in October and bridge modification finished in December 1960.

Any new flood control plan for the Jordan River will be combined with the concept of a parkway along the lower stretch of the stream. It is certain that increased public concern for the environmental values of the river will be a major factor in the formation of a proposed project.

In the summer of 1958, Congress passed Public Law 90-483 which authorized improvement to Weber River and its tributaries. Located north of the sprawling Hill Air Force Base, the river flows right through the City of Ogden, Utah. Efforts to control the stream have been an on-again, off-again endeavor. The original authorization expired in April 1967 due to lack of required assurances of local cooperation. Then in 1968, the project was again authorized, but has had to be modified because Morgan County was unable to provide the necessary assurances for its portion of the work. As it stands now, the project calls for channel enlargement and bank revetment, modification to a railroad bridge, removal of two diversion dams near Ogden, selective clearing downstream from Plain City Dam to the confluence of the Ogden River, and general channel clearing and snagging at intermittent locations in Davis and Weber Counties. When finished, the project will supplement, and work in conjunction with, the Bureau of Reclamation's Weber Basin reservoirs.

Preconstruction planning was started in the fall of 1960, but suspended less than two years later because Morgan County failed to make the needed assurances. Preconstruction planning for the modified project was resumed in December 1971. Upon completion of the improvement, about 15,000 acres of agricultural land will be protected from the ravages of floods. Moreover, another 1,900 acres of urban developments within the city of Ogden will also avoid the ruination that accompanies a major flood.

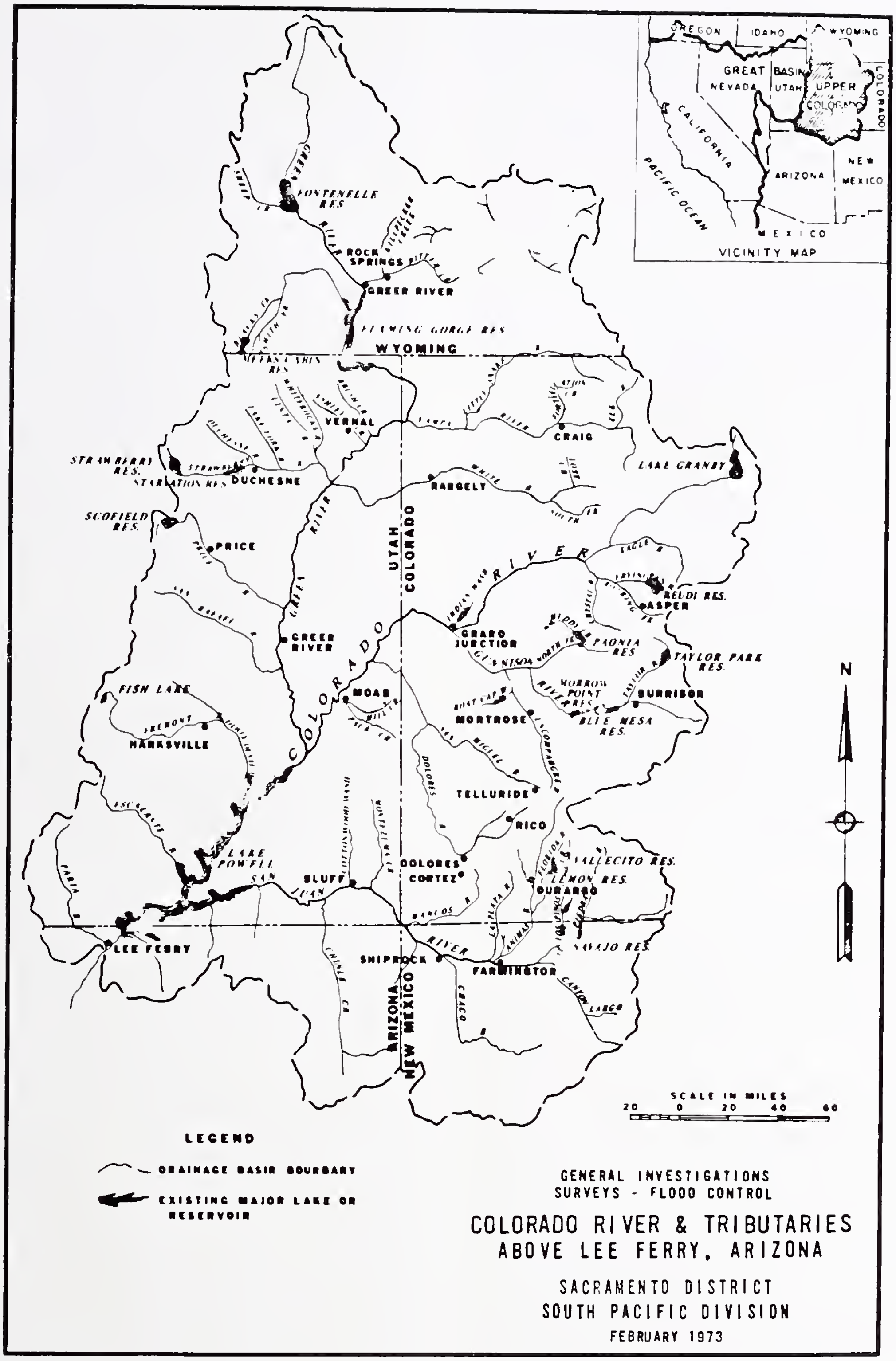
Based on comments received from local interests, it will be necessary for the project plan to be reformulated. A parkway plan proposed by local interests must be evaluated and determination made as to willingness of local interests to provide local cooperation requirements. Future course of planning on the project is pending a decision by local interests regarding the parkway plan and local cooperation.

Far and away the biggest (most expensive) civil works project currently being planned by the Sacramento District within the Great Basin is Little Dell Dam and Lake. Authorized in 1960 and modified by the Flood Control Act of 1968, the $33 million dam and reservoir will be located in the hills on Dell Creek, eight miles east of Salt Lake City. The dam itself is designed to be an earthfill structure, and will store 30,000 acre-feet of water. While flood control is the major consideration, much needed municipal and industrial water supplies as well as recreation will be provided when the work is complete. Serious flood damage will be prevented in Salt Lake City and, at the same time, residents will be able to tap a new source during the dry months.

Local interests will have substantial responsibilities in getting the job completed, and in operating and maintaining the facility once finished. For example, they must secure, without cost to the United States, all water rights necessary for operation of the project; maintain and operate the existing Mountain Dell Reservoir, located a mile and a half downstream on Parleys Creek in accordance with appropriate regulations; administer project land and water areas for recreation and fish and wildlife enhancement; and inform affected parties exactly what the project will and won't do. Further, local interests are required to contribute the costs of lands, easements, rights-of-way, and

THESE FIVE GATES CONTROL THE FLOW OF THE JORDAN RIVER THROUGH SALT LAKE CITY. THE NATURAL CHANNEL WILL FLOW AS ALWAYS, BUT ANYTHING IN EXCESS OF ITS CAPACITY WILL BE ROUTED DOWN THE SURPLUS CANAL. THE NEED FOR SUCH A CANAL IS PRETTY EVIDENT AS SALT LAKE RESIDENTS BUILT THE FIRST ONE IN 1885. TODAY'S PROJECT SIMPLY INTRODUCES MUCH MORE CHANNEL CAPACITY AND MORE PRECISE CONTROL TO PROTECT A MUCH MORE DEVELOPED AREA.
(Army Corps of Engineers Photo)

FLOOD WATER FROM GLEASON CREEK FLOWING THROUGH ELY, NEVADA.
(Army Corps of Engineers Photo)


OREGON
IDAHO
WYOMING
GREAT BASIN
NEVADA
UTAH
UPPER COLORADO
COLORADO
CALIFORNIA
PACIFIC OCEAN
ARIZONA
NEW MEXICO
MEXICO
VICINITY MAP
FONTENELLE RES.
ROCK SPRINGS
GREEN RIVER
FLAMING GORGE RES.
WYOMING
VERNAL
CRAIG
LAKE GRANBY
DUCHESNE
RANGELY
SCOFIELD RES.
PRICE
UTAH
COLORADO
RIVER
RUEDI RES.
ASPEN
GREEN RIVER
GRAND JUNCTION
PAONIA RES.
TAYLOR PARK RES.
FISH LAKE
MOAB
MONTROSE
GUNNISON
BLUE MESA RES.
TELLURIDE
RICO
LAKE POWELL
BLUFF
DOLORES
CORTEZ
VALLECITO RES.
LEMON RES.
DURANGO
LEE FERRY
SHIPROCK
FARMINGTON
NAVAJO RES.
ARIZONA
NEW MEXICO
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SCALE IN MILES
20 0 20 40 60
LEGEND
DRAINAGE BASIN BOUNDARY
EXISTING MAJOR LAKE OR RESERVOIR
GENERAL INVESTIGATIONS
SURVEYS - FLOOD CONTROL
COLORADO RIVER & TRIBUTARIES
ABOVE LEE FERRY, ARIZONA
SACRAMENTO DISTRICT
SOUTH PACIFIC DIVISION
FEBRUARY 1973

relocations allocated to flood control, either in cash or in kind. They also will be required to repay the portion of the first cost allocated to water supply and to repay half the costs allocated to recreation and wildlife conservation.

Although, local contributions will amount to over $16 million. Preconstruction planning was begun in the summer of 1970 and is scheduled for completion by the fall of 1974.

About fifty miles west of the Nevada-Utah border, in eastern Nevada, is the town of Ely. Running through the town is a stream called Gleason Creek, which in past years has caused the local residents considerable concern and damage when it goes out of its channel. To lower the level of anxiety and materially reduce flood damages in the city of Ely, the Sacramento District studied the situation and formulated plans to control Gleason Creek. To this end, a small dam and reservoir were authorized by Congress in the Flood Control Act of 1960. In 1961, funds were provided for preconstruction planning, but detailed design studies were postponded until local interests guaranteed that their portion of the costs would be forthcoming upon request. On 8 February 1971, the City Council of Ely passed a resolution of intent to furnish the necessary assurances of local cooperation. Presently, preconstruction planning is scheduled for resumption in 1974.

A hundred miles east of Pyramid Lake, near the city of Elko, Nevada, are sites for three flood control reservoirs authorized in May 1950, to be built by the Corps of Engineers. The reservoirs would be created by earthfill dams on the North and South Forks of the Humboldt River and on the Marys River. Together, the new lakes would have a storage capacity of 250,000 acre-feet and would cost about $23 million. The projects, when and if completed, would reduce flood flows along the Humboldt River and its tributaries, which cause damage to agricultural lands, improvements, utilities, transportation facilities, and urban, residential and commercial properties. Besides the flood control benefits, the lakes would provide improved irrigation supplies and offer increased opportunities for recreation and wildlife conservation.

The project was deferred in 1954 because local interests failed to give the required assurances of cooperation. In 1961, the city of Elko furnished enough data to allow a restudy which resulted in the work being restored to the "Active" category in 1964. If things go as planned, preconstruction planning will begin in 1973.

UPPER COLORADO REGION

The Upper Colorado Region comprises the drainage basin of the Colorado River above Lee Ferry, Arizona, and the Great Divide Basin in south-central Wyoming. Situated west of the Continental Divide, the region includes sections of Arizona, Colorado, New Mexico, Utah and Wyoming. Bounded on the west by the Wasatch Mountain, and by those mountains that form the Continental Divide on the north and east, the area encompasses a total area of 113,496 square miles.

The first permanent settlement of the region was a small fort, built in 1832 by Antoine Robidou near the confluence of the Uinta and Duchesne Rivers. Soon thereafter, others settled the area and put up trading posts, which served as important supply depots for the Mormon pioneers in 1847, and later the 49'ers. Gold was discovered near Breckenridge, Colorado, in 1859; hence, much of the region's early history is deeply rooted in the mining industry.

The first, and for many years the most, significant exploration of the area was completed by Major John Wesley Powell between 1869 and 1875. Major Powell had served through the Civil War as an artillery officer. After the war, he worked as a college professor until he undertook the exploration of some 500 miles of the Colorado River system. During the late 1880s, the Corps of Engineers conducted investigations having to do with the possibility of navigation on the Green River.

Because of the remoteness of the area and its relatively sparse population, however, little federal work was completed in the Upper Colorado River Basin until well into the twentieth century. Present Corps of Engineers civil

works efforts in the area stem from studies completed in the early 1930s. In a 1934 report to Congress, it was said of the Colorado River that, "There is no river in the United States where there is a greater need for conservation of the destructive floods and the application of these waters to beneficial use, both for irrigation and domestic and industrial needs."

During the 1930s, Corps of Engineers activities in the Upper Colorado Region were under the jurisdiction of the Los Angeles District. From April 1942, to October 1943, the area became the responsibility of the short-lived Salt Lake District, but was subsequently returned to the jurisdiction of the Los Angeles District. Since 1968, the region has been under the jurisdiction of the Sacramento District.

Water resource development problems in the region involve flood control, water conservation, water importation, and recreation. Currently the Sacramento District is studying the overall flood control and related water resource problems so that a plan can be developed to solve the problems both on a local and regional basis.

Annual flood damages averaged $2.8 million in 1965. If current projections hold true, flood damages will increase to over $10 million per year by 2020, if no additional flood control programs are completed. It is believed that flood damages can be reduced considerably through an integrated program of flood forecasting, flood plain management and the building of reservoirs and levees, and by improving existing channels. Corps of Engineers projects will be designed to function with and act as integral units of the overall water resource developments in the Colorado River Basin.

In addition to those projects that will be studied, planned and constructed in the years to come, emergency situations often arise that can't be put off for another day, but must be acted upon immediately. This aspect of the District's responsibility was mentioned earlier in relation to Central Valley areas, but it applies to the Upper Colorado River Basin as well.

Two recent examples of this type of work come to mind, both of which occurred in Wyoming. In May of 1972, the little town of Daniel, located in southern Wyoming, was threatened by the fast rising Prairie Creek. Francis McGregor, Utah Resident Engineer, supervised $50,000 worth of work which contained the waters of Green River and kept Prairie Creek from flooding. Sixteen pieces of heavy equipment were used to build the levee embankment that saved the town.

Early in June of 1972, flood fighters were hard at it near Cokeville, Lincoln County, Wyoming. Here, too, Francis McGregor was in charge of the emergency levee work. Within only a few days, almost 2,000 feet of a three-foot high dike had been placed along the banks of Smith's Fork to keep the stream in its channel. Except for spilling on agricultural land, the work was completely successful.

Wrested from the wilderness by Mormons, miners, cattlemen and farmers, the Great Basin and the Upper Colorado River Basin have become rich and prosperous regions. In much of the area, mining and agriculture still rank as the leading industries, but manufacturing, food processing and tourism are rapidly gaining in importance. In Utah, for instance, manufacturing has become the state's major industry. To support the work of the Corps of Engineers and other governmental agencies, many of the nation's largest aerospace firms have built plants and located research facilities within the Great Basin. Hence, there can be no doubt that the region is on the move, and that the Sacramento District will play a continually expanding role in its development. It is indeed sad that General Dillard won't see the "opportunities and challenges to engineering" being brought to fruition, which he wisely foresaw back in 1968 when the area was transferred to the Sacramento District. The general gave his life in Vietnam.

The people of the region do see and appreciate the work undertaken on their behalf by the Sacramento District. A brief letter from the Town Clerk of Telluride, Colorado, sums up the feelings of many:

> Mayor Betty McPhee, the Board of Trustees and the people of the Town of Telluride wish to thank the Department of

the Army, Corps of Engineers, for your assistance to the Town of Telluride since the Cornet Creek flood.

Your efforts on behalf of the town are greatly appreciated, and the work done through your efforts now gives the people of Telluride a feeling of security due to the deepening and widening of Cornet Creek.

With sincere appreciation.

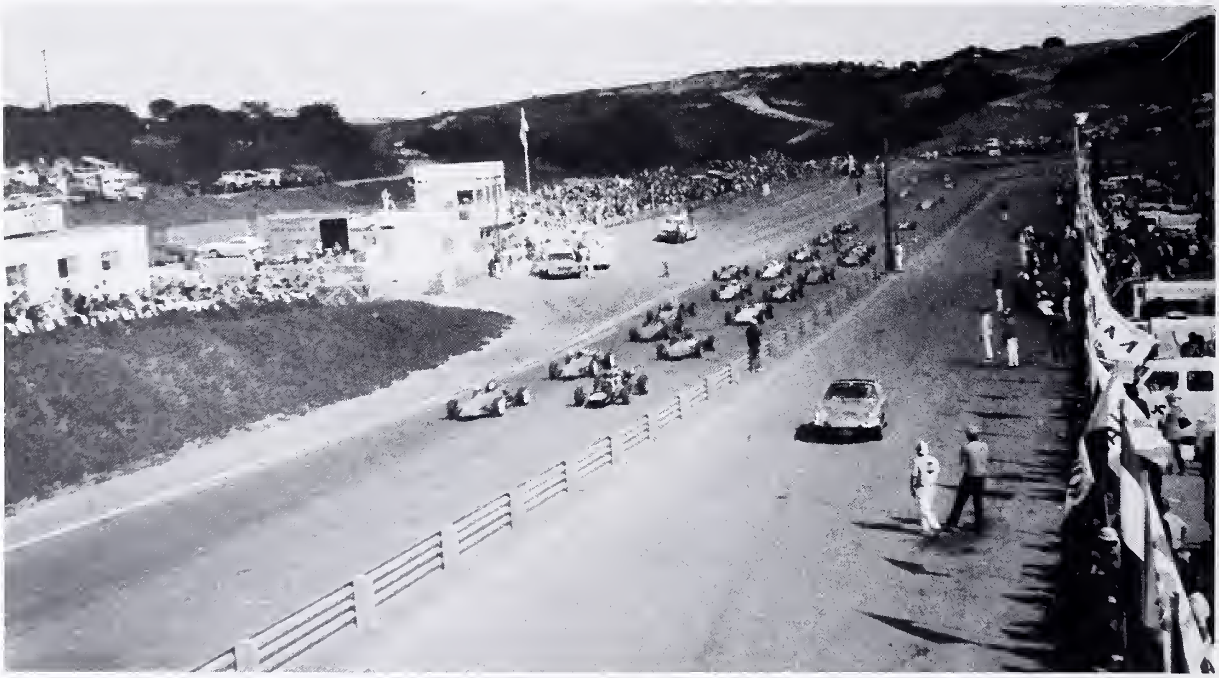
LAND, LEISURE AND LETTERS

LAND

It is entirely proper to dedicate this chapter to Creed B. Card. Until his untimely death in the fall of 1971, Mr. Card was a soft-spoken, dedicated civil servant, who had spent the last seventeen years of his life as Chief of the District's Real Estate Division. He came to the District in 1954 when the Real Estate Division consisted of only a handful of specialists. By the end of 1970, Mr. Card and his staff of sixty were administering about 4.6 million acres of federal land, including seventy-eight Army installations, 113 Air Force bases, eight Atomic Energy Commission facilities and other miscellaneous pieces of government property. Altogether, the District's Real Estate Division, in the fall of 1971, was involved with more than 240 installations.

As of September 1972, it was estimated that the value of the real estate under the administrative jurisdiction of the District's Real Estate Division was approximately half a billion dollars. In addition to the four and a half million acres of installations, the Division also administered 1,103 post offices, 1,382 military and 149 civilian in- and out-lease contracts.

Generally, one thinks of the Real Estate Division in terms of its traditional chores of appraising and acquiring land for new projects or for the expansion of existing facilities. But it also handles the leasing of privately owned land for government use; disposes of surplus lands and improvements; out-leases federal land and facilities for local public and private usage; checks to see that government-owned or leased land and facilities are being properly



MAIN STRAIGHTAWAY OF LAGUNA SECA ROAD RACING COURSE.
(Author Photos)

used; and insures that those who have contractual rights in land or facilities under Real Estate control are complying with the terms of the contract.

Few, if any, other divisions experience such diversity of situations as does Real Estate. On a given day, its representatives may be discussing the relative safety of Athena and Pershing missiles with tribal councils of the Navajo Indians, concerned as they are that one of the missiles may falter and drop from the sky as it passes over their land. The next day may find other real estate people delicately arranging the emotion-fraught removal and relocation of the remains of departed relatives from the path of an imminent District project. At other times, Real Estate personnel are leasing grazing land to ranchers, renting a parking space to an Army recruiter or buying a dam site for the government. The variety of its day-to-day operations is seemingly endless, and requires the full time efforts of the sixty-plus members of the Real Estate staff.

Whenever feasible, and compatible with the needs of those it serves, the office also develops secondary uses for flood control projects and military installations so as to bring additional revenue to the federal government while serving the primary needs of the government. For example, some 142,000 acres of land at Hunter Liggett Military Reservation are leased for cattle grazing. Perhaps one of the more unusual leases administered by Real Estate is that with the Sports Car Racing Association of the Monterey Peninsula, (SCRAMP). The racing enthusiasts lease the Laguna Seca road racing course, located at Fort Ord. The arrangements are handled by the Sacramento District. The mission of the office is to get the best possible deal for the government, based on fair market value. This kind of economy-minded real estate management system not only produces income for the U.S. Treasury, but also conserves Army funds which would otherwise be required to maintain the property.

PETER REVSON, WORLD FAMOUS RACE DRIVER, LISTENS INTENTLY AS AN ASSISTANT POINTS TO A WIDE RACING TIRE. IN THE BACKGROUND TIMERS AWAIT THE START OF THE NEXT RACE AT LAGUNA SECA.
(Author Photos)

Another rather unusual situation, handled by the Real Estate office, involves the compensation to persons who must leave their homes or jobs during those times when the Army conducts missile tests in a remote section of Utah. The government believes that it is appropriate to evacuate the area in which the missile(s) will travel. Most of the time, the people are required to leave the area for no more than a few hours, and there is always ample warning.

While the vast majority of real estate transactions are handled reasonably and peacefully, on occasion "gun totin', irate oldtimers" have been known to take potshots at the real estate boys. Mr. Card once remarked that, "It isn't always easy to convince the landowner that we're serving him." He went on to tell the following story:

> A few years ago, the District was purchasing land to extend McClellan Air Force Base. As Lee Jacobson, Chief of the Acquisition Branch, approached an old shanty located on land needed for the new work, he found himself face to face with a rather unhappy landowner. He could tell he was unhappy, and not in the mood to discuss selling his property, from the look on his face and the sawed-off shotgun he held in his hands. Jacobson's suspicions were absolutely confirmed when the fellow packing the gun ordered him off the place. Lee didn't feel it would be wise to argue the point and left in a hurry. Later on, the deal was settled through friendlier negotiations.

The Constitution permits the government to acquire private land needed for government use. It also requires that private parties be justly compensated. If the landowner and the Corps' representative can't agree on the fair market value of a piece of property, both have legal recourse. If a settlement can't be worked out by negotiations, then the federal courts will determine a fair price.

Since the Sacramento District handles real estate activities for the San Francisco District, real estate boundaries do not coincide with the District's civil and military boundaries.

LEISURE

The attitudes held by Americans concerning recreational activities form an important aspect of our value system. Very early in our history it was commonly remarked that "all work and no play makes Jack a dull boy." Today in the United States, and especially in the West, an expanding population with more leisure time, more money to spend, and increased mobility, continues to demand additional opportunities to enjoy the outdoors. Hence, the clamor for outdoor recreation has grown each year until it has become necessary in many areas to make reservations, often months in advance, for the use of particular camp sites.

The Sacramento District's civil works program of developing and conserving the water resources of the West contributes to the region's outdoor recreational opportunities. Morevover, outdoor recreation facilities are recognized by the District as tangible and important functions of water resources development. Accordingly, consideration is given to the requirements and potentialities for recreation whenever projects are being planned.

Congress long ago recognized the recreational possibilities of Corps of Engineers water resource development projects. In the Flood Control Act of 1944 (as amended), the nation's lawmakers authorized the Corps to participate in recreational development. Under Section 4 of the Act, the Corps of Engineers could construct, operate, and maintain public park and recreational facilities at water resource development projects under the jurisdiction of the Department of the Army. The 1965 Federal Water Project Recreation Act was passed to "provide uniform policies with respect to recreation and fish and wildlife benefits and costs of Federal multi-purpose water resource projects. . . ."

The intent of Congress is clear: "That it is the policy of Congress and the intent of this Act that (a) in investigating and planning any Federal . . . water resource project, full consideration shall be given to the opportunities, if any, which the project affords for outdoor recreation and for fish and wildlife enhancement . . ." The legislation is

SWAPPING TALL TALES IN THE DAWN LIGHT ARE THREE FISHERMEN ON THE SHORES OF LAKE ISABELLA NEAR BAKERSFIELD, CALIFORNIA. THIS SACRAMENTO DISTRICT, CORPS OF ENGINEERS, FACULTY COMES UNDER THE NATIONAL RECREATION LAND SYSTEM AND IS EXTREMELY POPULAR WITH SOUTHERN CALIFORNIANS.

(Army Corps of Engineers Photo

FAMILY CAMPING AT NEW HOGAN DAM AND LAKE NEAR STOCKTON, CALIFORNIA.
(Army Corps of Engineers Photo)

SAILING AT BLACK BUTTE LAKE NEAR ORLAND, CALIFORNIA.
(Army Corps of Engineers Photo)

particularly significant because through it, the federal government assumes responsibility for major recreational development, as long as local interests provide the necessary assurances. Generally speaking, recreation development is completed through cooperative arrangements by the Corps of Engineers and non-federal public agencies, and when appropriate, by private interests on a concessionaire basis.

During the Depression years, residents of the District were primarily concerned with securing the basics of life. The first half of the forties was spent producing the war materials for the arsenals of democracy. With the postwar boom in national development and attempts to escape the reality of possible nuclear war, residents of the District and the rest of the country turned to the great outdoors to refresh their collective spirits. In other words, the average person's total requirements for self-renewal could not be met with a steady diet of Milton Berle, Hopalong Cassidy, Howdy Doody, or even the Kinsey Report.

In a country where a man considers it a part of his birthright to go camping, the need for outdoor recreational development is obvious. After the war, the Sacramento District began to build as never before. Into the plans went designs for campgrounds, boat ramps, picnic areas, and conservation facilities. Presently, recreational opportunities are being provided as rapidly as possible, but still the demand at Corps of Engineers projects for space continues to exceed the capacity of the available facilities. By 1962, more than 4 million people a year were visiting the 13 Corps operated reservoirs within California. In 1972, more than a million visited the Sacramento District's Lake Isabella alone.

Since 1961, the Sacramento District has actively participated with various federal and state agencies engaged in Delta recreation planning. For a time, Colonel Turner was an ex-officio member of the "Sacramento River and Delta Recreation Study Committee." Mr. George Weddell was a member of the staff committee of the organization, and then continued to represent the District as a member of the Resources Agency Interdepartmental Committee for Delta Recreation Planning. In addition, the District has participated in the development of the recreational master plan for the Delta, and has made studies of recreational potential, existing patterns of use, and forecasts of future recreational needs. Examples of some of the studies made are: Pilot Levee Maintenance Test Sites; San Francisco Bay to Stockton Navigation Study; Sacramento River Bank Protection Project; Delta Recreation Study; Flood Control and Navigation Studies. In view of the increasing interest in outdoor recreation, boating, and use of the inland waterways, the District sees the eventual need for a master recreation plan for the rivers extending from Red Bluff through the Delta all the way to the upper San Joaquin Valley.

Recreation, the important by-product of the District's civil works program, is a prime example of the use of land and water to get the full benefits from resources development projects. The Sacramento District has a continuing program aimed at improving and expanding recreation areas. As funds are available, improvements will be made where they are most needed.

LETTERS

In August 1970, Congress passed the Postal Reorganization Act (P.L. 91-375), which removed the Post Office Department from the Federal establishment and converted it into a quasi-government corporation: The U. S. Postal Service. Under the new organization, the Postal Service was to be self-sustaining. No longer would it be a dependent of the federal government; it would finance its own operations from its own receipts and revenues. To assist the new organization in making the transition, the Postal Service was authorized to budget up to $2 billion annually for the construction of new facilities, as opposed to the historical $80 million usually appropriated by the Congress.

The massive increase in design and construction potential dictated that a new method of planning, design and construction be ef-

RECREATION BARGES RESTING AT ENGLEBRIGHT LAKE.
(Army Corps of Engineers Photo)

ANNUAL VISITATION AS REPORTED TO OCE

PROJECT	1960	1961	1962	1963	1964	1965
Black Butte					107,600	155,820
Englebright	39,300	46,700	49,300	55,600	103,200	131,970
Isabella	782,200	606,000	716,700	724,800	1,246,600	1,312,530
New Hogan				39,600	103,400	248,880
North Fork	40,300	40,100	43,000	42,500	39,600	38,130
Pine Flat	345,400	412,500	471,200	528,600	663,200	491,050
Success		80,600	342,400	586,800	603,200	568,050
Terminus			116,100	199,900	368,400	455,370
TOTAL	1,207,200	1,185,900	1,738,700	2,177,800	3,235,200	3,401,800

	1966	1967	1968	1969	1970	1971	1972
Black Butte	213,390	179,740	148,770	136,940	156,390	232,300	222,290
Englebright	125,370	108,500	101,220	114,170	117,500	92,340	125,710
Isabella	1,429,890	1,604,850	1,673,270	1,381,110	1,558,315	1,455,447	1,147,001
New Hogan	344,210	300,530	343,220	294,180	254,900	321,090	259,380
North Fork	38,600	22,850	26,430	25,000	—	—	—
Pine Flat	589,240	592,270	523,800	565,700	609,000	628,220	610,080
Success	565,990	400,960	490,430	533,300	627,450	549,890	514,206
Terminus	396,600	215,410	328,870	300,590	344,240	382,660	313,420
TOTAL	3,703,290	3,425,110	3,636,010	3,350,990	3,667,795	3,661,947	3,192,081

fected. After considering several alternatives, Winton Blount, Postmaster General, chose to enter into agreements with the Chief of Engineers, Lieutenant General Frederick J. Clarke, whereby the Corps of Engineers would accomplish the design and construction of new postal facilities. In addition, the Corps agreed to handle real estate activities for the Postal Service, including acquisition, lease servicing and disposal of postal properties.

In a statement to *The Daily Pacific Builder*, Colonel Donovan outlined a few of the ramifications of the real estate responsibilities:

> Because of the types of land required in the Postal Services program, our real estate land acquisition program problems have increased. For example, a three-block area of land consisting of homes, businesses and two large rental units is being acquired at the Oakland Post Office Site. Because of the age of the neighborhood and the low average income of the residents, the benefits available to them under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 are being used to the fullest extent. We are employing the services of the local Redevelopment Agency to assist displaced persons and businesses in locating and buying suitable replacement property.

A year later, in the fall of 1971, the Sacramento District was assigned missions to administer and supervise postal real estate activities for both the San Francisco and Sacramento Districts, to accomplish design and construction of all major facilities in North Pacific and South Pacific Divisions, and to supervise construction of all postal projects within the San Francisco and Sacramento Dis-

COLONEL GEORGE B. FINK — SACRAMENTO DISTRICT ENGINEER, U.S. ARMY CORPS OF ENGINEERS, 1968-1970.

tricts. Only two weeks later, the District post office program reached a milestone with the announcement of invitation for bids to construct a U.S. Post Office and Vehicle Maintenance Facility in Fresno. This project had added significance because it was the first District-influenced design of a post office. The other post office projects acquired earlier were in mid-construction and thus had been designed by other agencies.

To complete successfully this expanded design responsibility, a Postal Facilities Branch was activated within the Engineering Division. At first the workload of the new branch consisted primarily of reviewing contract plans prepared by design consultants retained by lessors. This was necessary because nearly all postal facilities under design at that time were to be privately owned but leased by the Postal Service.

The Sacramento District's postal program was expected to total more than fifty million dollars in new construction each year, and cover eight western states in its design responsibility. Actually, the District's post office construction boundaries paralleled its military boundaries in California, Nevada and Utah. Further, it was expected that three types of post offices would be constructed by the District: Regional, preferential mail and bulk mail. Regional facilities are rather small and are meant to serve local areas. A preferential mail post office is one that handles first, second and third class mail, and generally costs between $4 million and $10 million to build. The largest of all are the bulk mail post offices, which handle only packages and cost from $30 million to $40 million. Commenting on the newly acquired mission, Roan Aicklen, head of the new branch said:

> In my opinion, it is the single most important program the Corps has undertaken in many years. We are upgrading over 3,000 existing small post offices in the states of California, Nevada, Arizona and Utah and will soon design three of the twenty-one nationwide bulk mail handling facilities and twenty preferential mail centers. The District will be doing some construction work, too. We will build the $30 million San Francisco bulk facility that has just been announced (January, 1972) to be located in Richmond. . .

Just as in planning dams and reservoirs, post office construction planning required the District to assess the environmental effects of all new work. If the construction would adversely affect the human environment significantly, then an environmental impact statement would have to be prepared, a major task in itself.

By the fall of 1972, the Postal Facilities Branch had attained a strength of twenty-eight people and was operating at an annual work placement rate of about $125 million. Obviously the new branch, with assistance from the District's real estate, construction and support organizations, could accommodate any imaginable program that the U.S. Postal Service would be likely to authorize.

Mr. Aicklen had barely gotten acclimated to his new position and set up the new branch when, on 5 February 1973, the District received word from OCE that the Executive Branch, Office of Management and Budget, had issued instructions to the Department of the Army to terminate Army involvement in the postal facilities program. The dissolution of the partnership was to be accomplished in two phases. First, all real estate action and all design and construction projects of less than 50,000 square feet were to be transferred to the Western Regional Headquarters of the U.S. Postal Service by the end of June 1973, with a commensurate reduction in District staffing. Secondly, an additional twelve months were granted to terminate all further postal activities, with a reduction in District personnel in support of this work to zero. What promised to be a challenging and rewarding assignment for the District was, in reality, ended before it began. No doubt, the postal facilities' real estate, design and construction program was the shortest-lived major program ever assigned to the Sacramento District.

CHAPTER X
PARTNERSHIP, PLANNING & PREVIEWS

Partnership Projects:

The Sacramento District covers a large part of the Western United States. Hence, it would be presumptuous to assume that the Corps of Engineers could alone meet all of the water resource needs of the manifold interests residing within its boundaries. The immense task of water resource development is shared by many federal, state and local agencies working together to plan and build projects that will complement each other. Even before the turn of the century, the Corps of Engineers cooperated with state and private interests to clean up the rivers and improve navigation. During the 1920s and 1930s, the Sacramento District worked with the State of California and the Federal Power Commission to prepare the "308" studies, improve irrigation and navigation, and to bring flood control to the Central Valley. It will be remembered that the massive Central Valley Project was originally planned as a state development, then assigned to the Corps of Engineers, and finally through presidential intervention, awarded to the Bureau of Reclamation.

The Corps assisted the Bureau in planning the individual facilities of the Central Valley Project by sharing its studies and scientific data collected over many years. Since the second world war, the Sacramento District has contributed funds to five major federal dam and reservoir projects within the state. An overview of each will demonstrate that cooperation is essential if the needs of all are to be met.

Tuolumne River Reservoirs Project:

Mountainous Tuolumne County is a backpacker's paradise. Part of Yosemite National Park lies within the County, and hundreds of miles of streams and several reservoirs offer the recreationist fishing, boating and water skiing. The Tuolumne River watershed has been developed extensively by the City and County of San Francisco and the Turlock and Modesto Irrigation Districts. Hetch Hetchy Reservoir, Lake Lloyd and Lake Eleanor store water that is used to generate power. Then the water is conducted 175 miles by aqueduct to San Francisco.

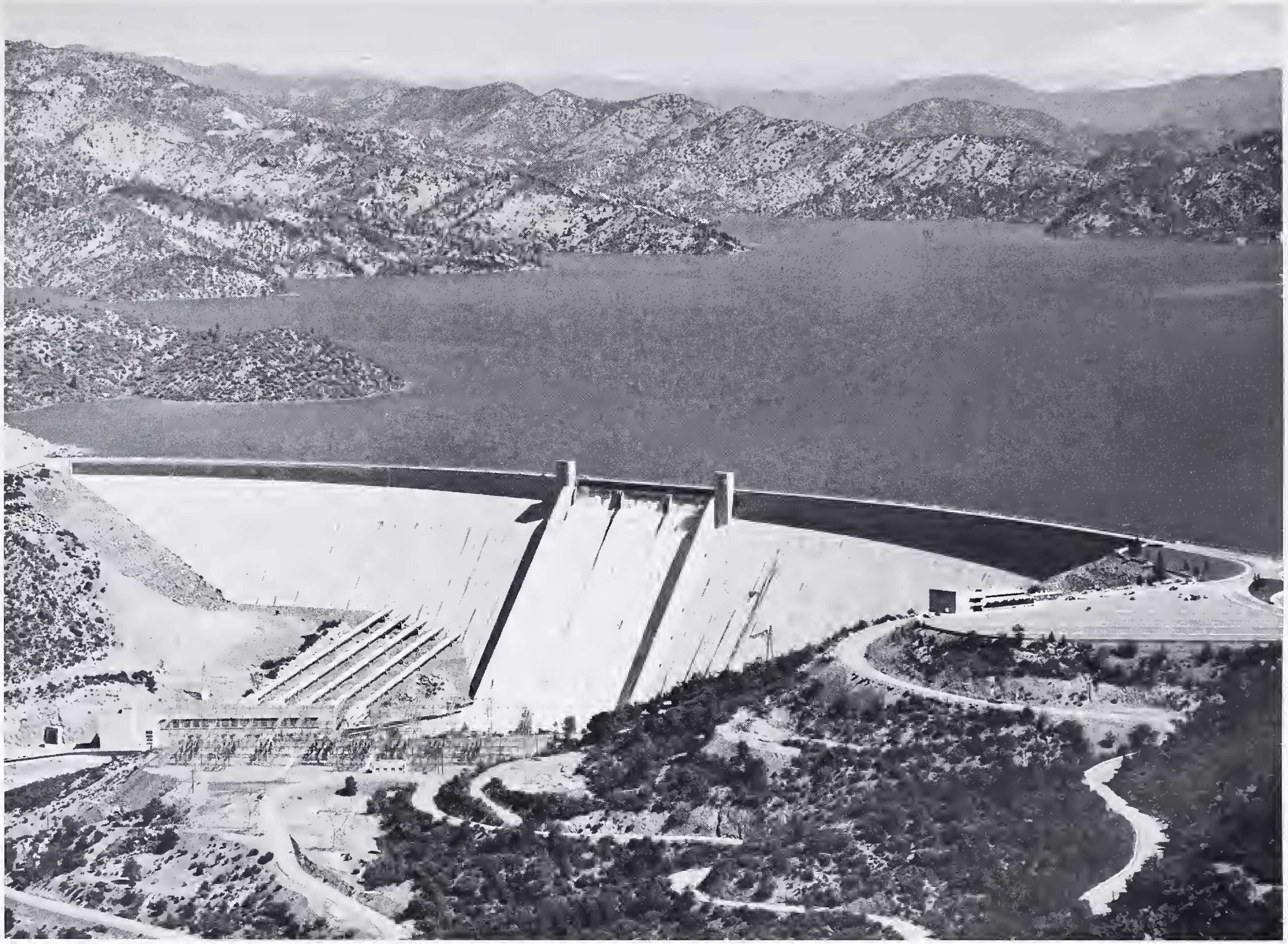
The Sacramento District was authorized by the Flood Control Act of 1944 to participate in reservoir construction on the Tuolumne River. The first phase of this development was the construction of Cherry Valley Reservoir, which was completed in 1957. In return for the flood protection provided by the facility, the federal government contributed $9 million to the first cost of construction.

Southwest of Cherry Valley Reservoir is the New Don Pedro Dam and Reservoir, which represents the final phase in the joint effort to develop the Tuolumne River for irrigation, power, domestic supply and flood control. The $75 million project is located about thirty miles east of Modesto in the foothills of the Sierra Nevada Mountains. Of the total storage capacity of 2,030,000 acre-feet, 340,000 acre-feet is utilized for flood control. The Corps of Engineers has compensated the local agencies for this by contributing more than five and one-half million dollars to the project. The contract for New Don Pedro was awarded in the fall of 1967. Closure was accomplished on 2 November 1970, and the complex became operationally complete for flood control purposes during 1971.

The Tuolumne River Reservoirs Project is a significant and integral part of the design for flood control on the lower San Joaquin River and its tributaries. Substantial protection is provided to the City of Modesto, to several rural communities, and to thousands of acres of rich farm lands in the northern San Joaquin Valley and Delta. It has been estimated that several million dollars in damages would have been prevented had the reservoirs been operational during the floods of 1955, 1958, 1964 and 1967.

Oroville:

On 27 November 1962, Colonel Herbert N. Turner, Sacramento District Engineer, presented a check of $13,950,000 to William E. Warne, Director of the State Department of Water Resources. The U.S. Government check was the first installment of the federal gov-



SHASTA DAM, KEY UNIT OF THE CENTRAL VALLEY PROJECT.
(Bureau of Reclamation Photo)

NEW DON PEDRO DAM — 15 NOVEMBER 1970

ARRIVING AT OROVILLE FOR THE OROVILLE DAM DEDICATION CEREMONIES ARE U.S. ARMY CORPS OF ENGINEERS REPRESENTATIVES (FROM L. TO R.) COLONEL RAYMOND W. DE LANCEY, DEPUTY SOUTH PACIFIC DIVISION ENGINEER; LT. COLONEL LEWIS A. PICK, JR., ASS'T DIRECTOR FOR CIVIL WORKS, OCE; MAJOR GENERAL FREDERICK J. CLARKE, DEPUTY CHIEF OF ENGINEERS, OCE; COLONEL CRAWFORD YOUNG, SACRAMENTO DISTRICT ENGINEER; AND BRIG. GENERAL ARTHUR H. FRYE, JR., (USA RET.) 4 MAY 68.

(Army Corps of Engineers Photo)

OROVILLE DAM
(State of California Department of Water Resources Photo)

ernment's contribution for flood control features of Oroville Dam and Reservoir, key unit of the State Water Project, the largest single water resource development program undertaken in the United States. Colonel Turner presented the check to the state at a ceremony attended by members of Congress and other high ranking officials.

Early in 1962, President Kennedy approved the federal contribution to the project for 22 percent of the actual construction cost of the dam. Based on an estimated cost of $300,398,000, the federal contribution amounted to $66,000,000. Annual payments were made throughout the construction phase.

The main dam contract was awarded in August 1962, and closure accomplished five years later on 6 October 1967. The State of California sponsored dedication ceremonies for the project on 4 May 1968, and by the summer of 1968, all power units went on line.

Oroville Dam is a massive rock and earthfill structure. In fact, the 770 foot high barrier is the highest dam of its kind in the country, and creates a 3,538,000 acre-foot reservoir which is used for flood control, irrigation, water supply and hydroelectric power generation. Located on the Feather River about four miles northeast of Oroville, the project has greatly reduced the danger of flooding to the towns of Oroville, Marysville, Yuba City, and many other smaller communities in the flood plain. Moreover, about 283,000 acres of highly developed agricultural land and vital highway and rail lines are protected as well. To those who remember the Christmas floods of 1955, the dam stands as a monument to victims of rivers gone mad.

Camanche and New Exchequer:

The Flood Control Act of 1960 authorized federal participation in a pair of multipurpose reservoirs within the Sacramento District. Camanche Dam and Reservoir is located on the Mokelumne River about twenty miles northeast of Stockton. The project was built and is operated by the East Bay Municipal Utility District. The barrier is a rockfill structure with an impervious earth core, 171 feet high, and having a total crest length of 19,250 feet. The main dam, together with half a dozen dikes, creates a reservoir of 431,500 acre-feet which is used for flood control and domestic water supply and recreation.

President Kennedy approved a federal contribution of more than $10 million for the project on 9 March 1962. Contracts were let and construction got underway in the spring of 1962. Closure was achieved in November 1963, and the facility declared operationally complete in the spring of 1964.

The residents of Lodi and Woodbridge can, since its completion, breathe easier with one less thing to worry about. During just one flood, that of December 1964, the project prevented damages amounting to $1,600,000. Unfortunately, it wasn't in place sooner for, had it been built only a dozen years earlier, an estimated two million dollars in damages would have been prevented.

New Exchequer Dam is unique in that the original gravity arch structure was incorporated into the upstream toe of the new dam. The project was built on the Merced River by the Merced Irrigation District just after its northern neighbor, Camanche, had been placed across the Mokelumne River. New Exchequer, a rockfill dam with a reinforced concrete upstream face, was started in 1964 and completed in 1966.

Federal interest in the project, of course, is the flood protection the new facility provides. To cover the cost of the portion dedicated to this purpose, a contribution in excess of $10,500,000 was made by the government, about 38 percent of the cost of the dam. Flood control operation of the facility affords a substantial measure of protection to many towns and villages, and some 50,000 acres of land devoted to agricultural use within the Merced River flood plain. The project also helps meet the urgent need for additional irrigation water, while its powerplant generates hydroelectric power to light the farms and run the factories of the valley.

The new dam has increased the size of the reservoir from 281,000 acre-feet to over a million acre-feet. And, to the benefits of irrigation

BULLARDS BAR DAM — 5 JUNE 1968
(Army Corps of Engineers Photo)

water and power are added flood control and general recreation. The flood control portion of the new facility amounts to 400,000 acre-feet.

New Bullards Bar:

The most recent major partnership project completed within the perimeters of the Sacramento District is the New Bullards Bar Dam and Reservoir, located on the North Yuba River about thirty miles northeast of Marysville. Working in conjunction with the massive Oroville barrier, the two dams protect one of the most often flooded regions of the state. For almost a century, the Yuba country had suffered the consequences of man's carelessness. Not many years ago, even a moderate rainstorm would swell the debris-choked Yuba River to overflowing. Untold sums were spent on levees, but often the water-logged dikes would give way in the face of the raging river.

The Flood Control Act of 1965 authorized federal participation in the construction of the New Bullards Bar project. Federal contributions to date have been in excess of $13 million. Constructed by the Yuba County Water Agency, the project consists of a 645 foot high concrete arch dam which creates a reservoir of 930,000 acre-feet. In addition to flood control, the project stores water for irrigation, power generation, recreation, fish and wildlife conservation and related purposes. The reservation for flood control alone is 170,000 acre-feet.

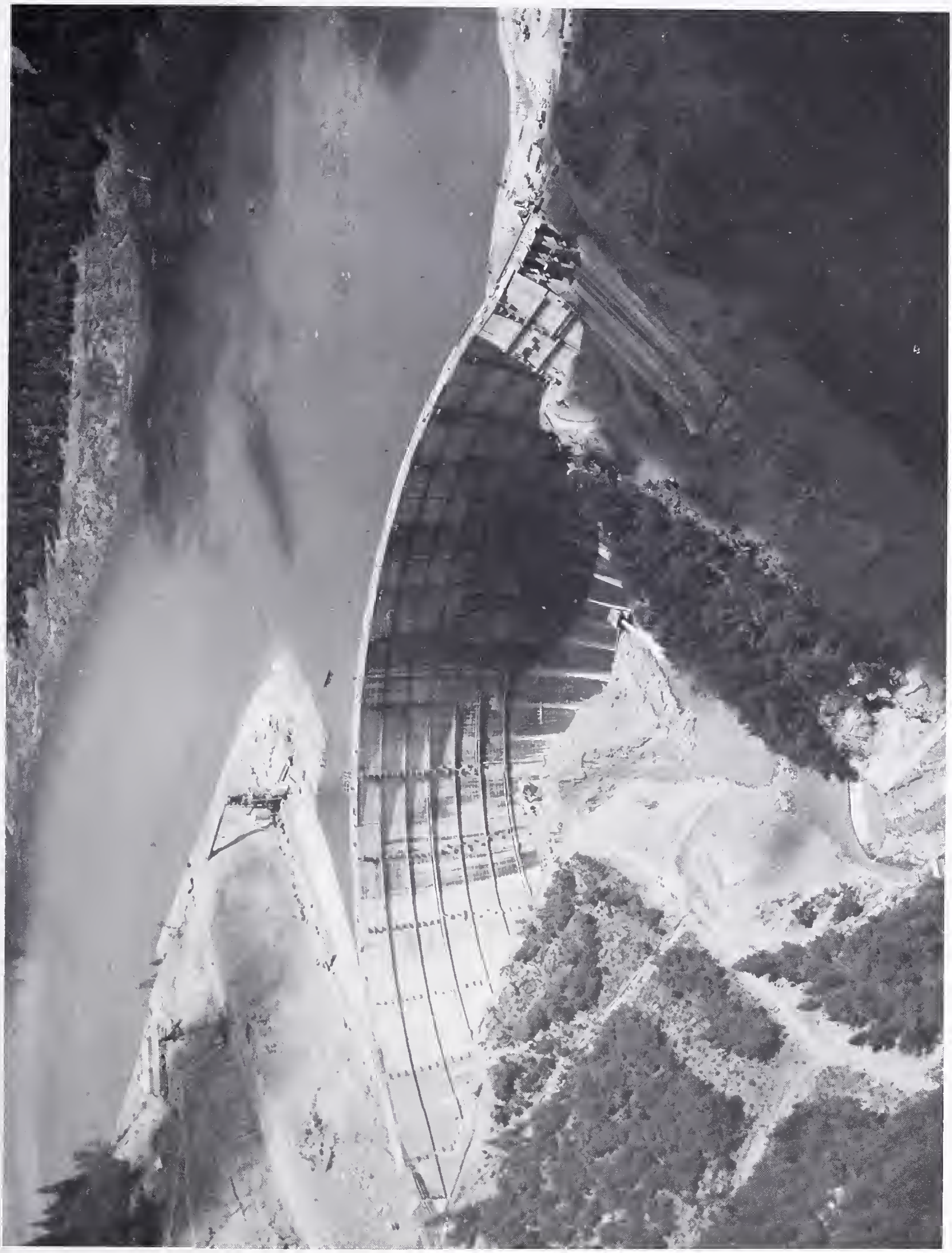
Regardless of who builds a project and who pays a portion of the costs for contracted services, the system of cooperation serves all the people and eliminates the duplication of facilities. Moreover, the public can be sure that everyone is paying his fair share for services rendered. Finally, it would be unreal to believe that there won't always be competition among governmental and private agencies for construction work. For that matter, people don't always agree on what should be built and who should pay for it. Nevertheless, by working together for the good of all concerned, good results are sure to transpire.

PLANNING

The Corps of Engineers never initiates an investigation or a project, but only prepares reports and constructs projects as directed by Congress. For example, let's assume for a moment that you reside in a community that is frequently inundated by a stream that passes through the area. Having suffered the ravages of floods long enough, you and your neighbors decide to do something about the situation. The local Congressman is called in to hear your complaints. He feels that your cause is just. Two courses of action are now open to him: He may request the Senate or House Committee on Public Works to authorize a review of any previous studies that are available to determine whether any modifications should be made to existing reports. If a review report is appropriate, a resolution will be adopted authorizing the Corps of Engineers to make the review. On the other hand, if no previous surveys have been done in your area, the Congressman may introduce a bill in Congress to authorize the desired investigation. If passed, the legislation becomes an authorization for the investigation.

Once authorized, the Chief of Engineers assigns the work to the appropriate Division Engineer, who, in turn, directs the District Engineer to accomplish the task. Working closely with other federal, state and local agencies, personnel from the District begin the required engineering and economic investigations. Public meetings are held to determine the feelings of the local people as to the scope and type of project desired. After careful consideration of these views and the data prepared by professionals in the field, the District Engineer draws up a plan of improvements that he deems best suited to correct the problem. Estimates of benefits and costs are prepared, and the degree of local cooperation determined. Because some people of the community may fail to agree that the proposed plan is the best alternative, the District Engineer solicits opinions from all factions. Local acceptance and economic justification are prime ingredients in a favorable report by the District Engineer.

In recent years, the possible effect upon the environment has assumed a prominent position in the hierarchy values that ultimately



BULLARDS BAR DAM — JUNE 1969

determine whether or not a project will be constructed. Since the passage of the National Environmental Policy Act in 1969, the Corps is required to study all possible alternatives involved in a given project. Moreover, an Environmental Impact Statement must be prepared that examines the possible effects the work will have on environment. Once all of this has been completed, the entire plan of improvement is reviewed by the Division Engineer, Chief of Engineers, the Board of Engineers for Rivers and Harbors, the Secretary of the Army and the Bureau of the Budget. All the while, public notices keep interested parties informed so that they may make their feeling known and/or submit any new data. In addition, the House and Senate Committees on Public Works may decide to hold hearings on the plan with a view toward formulating legislation to authorize the improvement. Passage of the legislation constitutes authorization of the project, but does not authorize funds for the work to be done. Subsequent acts are necessary to provide money to get the job done. Assuming that your neighbors agree with you, and the work is authorized, it must be built in accordance with the authorizing acts and all other laws that are applicable, at a rate determined by the appropriation of funds.

The Flood Control Act of 1970 provides us with two actual examples of projects that are presently in various stages of planning. The larger is the Cottonwood Creek Project located northwest of Red Bluff, California. The plan of improvement consists of a pair of multipurpose reservoirs to be constructed on the main stem and on the South Fork of Cottonwood Creek, mid-way between the cities of Red Bluff and Redding. The larger of the two, known as Dutch Gulch Dam would extend a little over four miles, attain a maximum height of 268 feet, and create a 1,100,000 acre-foot reservoir. The Tehama embankment, including both the main dam and a dike, would be more than six and a half miles long, reach a maximum height of 238 feet and hold back about 900,000 acre-feet of water. Together, the reservoirs would store about 2,000,000 acre-feet of water for flood control, irrigation, municipal and industrial water supply, recreation, and fish and wildlife conservation. Eight thousand acres of agricultural lands along Cottonwood Creek would be protected from floods. By reducing the flood flows of the Sacramento River, the dams would add materially to the protection of some 440,000 additional acres of farm and orchard lands in the Colusa and Butte Basins. The project also illustrates an example of Corps of Engineers cooperative efforts with local agencies in that part of the development is designed to provide municipal and industrial water supplies and new water for irrigation.

The other project authorized by the 1970 Flood Control Act involves the enlargement of four existing dams, the construction of three new reservoirs, and more than fifty-two miles of levee improvements in Merced and Mariposa Counties, California. Planning on a limited scale has been underway to enlarge Bear, Burns, Owens and Mariposa Dams, projects previously discussed. The new work being considered consists of constructing Castle Lake on Canal Creek, Haystack Mountain Dam on Black Rascal Creek, and Marguerite Dam on Deadman-Dutchman Creeks. When and if completed, these seven small projects will store 126,700 acre-feet of water for flood control, irrigation and/or recreation. None of the work has been started to date, but preconstruction planning began in Fiscal Year 1973. Here, too, is an example of federal and local cooperation. For services received, local agencies will be required to pay a portion of the first costs and the annual expenses of the project. In addition, local interests will have definite responsibilities regarding the settling of claims for water rights pertaining to the establishment and use of a permanent pool for recreation and fish and wildlife purposes.

Cottonwood Creek and the Merced County Streams Projects are, of course, only two of several examples that might be cited to illustrate the types of facilities currently receiving consideration by the Sacramento District. Each is unique and must be considered in terms of the particular circumstances and needs of the area in which it is located. On the

other hand, they are similar in that they share a common heritage of uniform procedures and precise studies prepared by men of unquestionable integrity, who are dedicated to protecting people as well as the environment.

Obviously, water resource development planning is a highly complex business. The Sacramento District doesn't assume the entire responsibility. Coordination and cooperation with numerous other agencies is essential. Planning on a regional basis is coordinated with the six federal agencies and nine of the southwestern states of the Pacific Southwest Inter-Agency Committee on Water Resources. Meetings are held at regular times throughout the year so that each member agency can share its plans and coordinate its efforts with the other members.

In California, the most significant coordination of water resource development planning is done by the California State-Federal Inter-Agency Group. This body is composed of representatives of the Corps of Engineers, the Bureau of Reclamation, the Soil Conservation Service, and the California Department of Water Resources. Often referred to as the "Four Agency Group," it meets quarterly to coordinate the projects of member agencies.

Because people have for years "built their homes in the rivers," that is, on lands that are subject to periodic flooding, there is an urgent need for flood hazard data. So that flood-prone regions can be intelligently managed, the Sacramento District, at the request of the various states and other local agencies, has completed several flood plain studies within the civil works boundaries of the District. Hopefully, the finished studies, and those currently underway, will guide the development of flood plain areas so that future flood damages will be reduced.

The Sacramento District, and the Corps in general, received authorization to prepare these studies through Section 206 of the 1960 Flood Control Act and by the amendments made to the Act in 1966. Part A of the Section states:

> In recognition of the increasing use and development of the flood plains of the rivers for information on flood hazards to serve as a guide to such development, and as a basis for avoiding future flood hazards by regulation of use by States and political sub-divisions thereof, and to assure that Federal departments and agencies may take proper cognizance of flood hazards, the Secretary of the Army, through the Chief of Engineers, is hereby authorized to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies, and general criteria for guidance of Federal and non-Federal interests and agencies in the use of flood plain areas; and to provide advice to other Federal agencies and local interests for their use in planning to ameliorate the flood hazards. Surveys and guides will be made for States and political subdivisions thereof only upon the request of a State or a political subdivision thereof, and upon approval by the Chief of Engineers, and such information and advice provided them only upon such request and approval.

Once again we can see that the Corps of Engineers does not decide which projects (or areas) to study, but is restricted by the requests initiated by others.

HYDROLOGIC ENGINEERING CENTER

Never satisfied with past accomplishments, the Corps of Engineers constantly seeks to improve its planning and engineering techniques and procedures. On Friday, 10 July 1964, Chief of Engineers Lieutenant General W.K. Wilson, Jr., announced the establishment of the Corps of Engineers Hydrologic Engineering Center at Sacramento. Colonel Robert Mathe, District Engineer, appointed Leo R. Beard, a nationally known hydrologic engineer on the staff of the Sacramento District, to head up the six man staff originally assigned to the Center. The decision to establish the Center resulted from three considerations:

1. The need to accelerate the improve-

ment of hydrologic engineering techniques, and to train engineers in more efficient applications of these techniques. The Center will serve as a pool of talent which can guide and supplement staff specialists in Corps' Division and District offices, and help train additional specialists.

2. The need to take full advantage of modern computer techniques for simulating and studying water phenomena that may occur under differing sets of circumstances that must be accurately taken into account in planning, designing and operating systems of facilities for the control and utilization of streamflow. This includes factors such as forecasting streamflow, floods, the quantity and quality of water available at specified times and places, the effects of depletion of streamflow under various possible alternative situations of patterns of rainfall and snowmelt, or man-made influences affecting water, and the kinds, design and location of optimum water development facilities.

3. The need to foster technological progress in hydrologic engineering through research, including better methods of computing flood and low-flow probabilities, improved techniques of evaluating and comparing the effects of potential developments and changes in river basins that would affect their water resource characteristics, etc.

During its brief history, HEC has grown in size and in the scope of its mission. In the beginning, the Center inaugurated a program of adapting traditional hydrologic engineering techniques to computers, and of training and helping the new generation of Corps personnel in those traditional techniques. Over the years, efforts have been directed toward adapting the latest mathematical procedures, such as systems analysis and stochastic processes, to the increasingly complex problems encountered in the field.

In the early seventies, public concern for the preservation and enhancement of the country's natural resources has warranted a major reorientation of the Center's mission. Presently, additional emphasis is being placed on developing hydrologic engineering techniques necessary for evaluating the environmental effects of changes in water regimes.

In light of this, much of the traditional training has been relegated to the universities, allowing the Center to concentrate its training in the newer areas such as stochastic hydrology, flood plain management, hydrologic systems analysis and water quality management.

Moreover, the Center maintains an extensive program for the exchange of information with universities and other organizations in order to take advantage of advances made by others to avoid duplication of effort. Not only Corps personnel but representatives of other federal, state and private agencies attend formal courses to learn about such things as "Ground Water Hydrology," "River Hydraulics" and "Reservoir System Analysis."

When it was established, HEC was located in the Federal Building at 650 Capitol Mall, Sacramento. In January of 1969, the Center was moved to Davis, near the campus and technical facilities of the University of California. By 1971, the original staff of six had increased to twenty-six. In addition to its regular staff, eighteen personnel from various Corps offices, members of seven other federal agencies, eight universities and four private organizations gave lectures at the Center during Fiscal Year 1971. That same year, fourteen foreign visitors, from India, Korea, Venezuela, Taiwan, Iran and Poland, came to the facility. Meanwhile, HEC members visited England, Brazil, Iran and Yugoslavia in official capacities.

On 30 June 1972, the very able Leo R. Beard retired from the directorship of the Center after guiding the facility for more than eight years. George Weddell, Chief of Engineering Division, served as acting Director until 10 September 1972, when Bill Eichert became the new Director of HEC. Prior to his elevation, Mr. Eichert served as Assistant Director and Chief, Training and Methods Branch, HEC.

AUTOMATIC DATA PROCESSING CENTER

An important planning facility used in the Sacramento District is the Automatic Data Processing Center. The ADP program has evolved over a period of some 17 years. The initial interest in the potential use of Automatic Data Processing in the Sacramento District originated, for the most part, in the Engineering Division during the mid-1950s. It was hoped that the use of computers would relieve engineers and technicians of burdensome computations. After an extensive feasibility study utilizing contracted computer services, it was concluded that it would be advantageous to secure a computer to aid in the preparation of engineering-scientific type computations. In the spring of 1964, a small scale unit (IBM 1620) was installed in the District office under the operational control of the Engineering Division.

On 19 September 1965, the ADP Center was officially established as an element of the Advisory and Administrative Staff of the District. The establishment of the ADP Center was a result of an OCE directive on organization, recognizing a greater emphasis on the role of data processing in the Corps of Engineers. In May 1970, a larger computer was purchased and installed in the *ADP Center*. The following month, the IBM 1620 was released. Future plans call for the replacement of the GE-225 during 1978.

PREVIEWS

There can be no doubt that the nation's awakening interest in the environment has, and will continue to exert, a powerful impact upon future projects undertaken by the Corps of Engineers. Little does it matter whether the planning involves a massive framework study or survey for a small local project. Of prime consideration will be the possible effects upon the natural condition of the area. The delay in construction of the New Melones project is an excellent example of the pressures that can be brought to bear by even a small group of individuals.

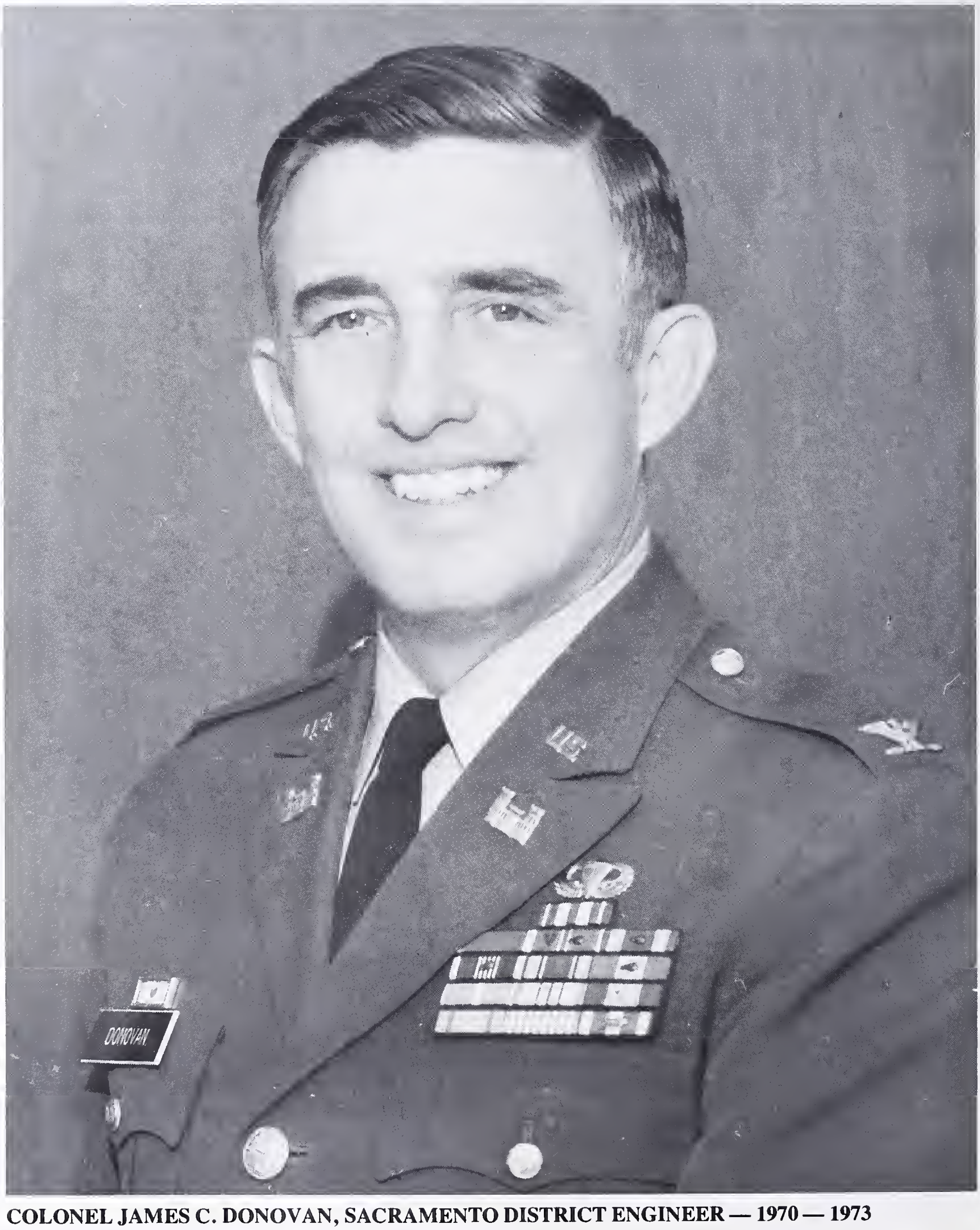
A recent example of the District's effort to enhance the local environment is the experimental planting of trees and shurbs on the waterside of levees at selected bank protection sites along the Sacramento River. Normally, trees tend to be a danger to the strength of levees because when they topple into the rivers, they leave a large hole in the bank which is easily eroded.

Colonel Donovan stated that, "With our earlier experimental planting sites at Monument Bend and Elkhorn Ferry we've proved that it can be done, but the cost is quite high. That's because each tree and shrub there was individually planted. If we can get the same excellent results through seeding. we can apply the process to other denuded reaches of levees at a far more reasonable cost."

The District's careful planning of the Cottonwood Creek reservoirs is yet another example of the increased awareness of environmental considerations. In a letter to General Fink in 1970, the conservation-minded Sierra Club declared that:

> . . .development provides very substantial benefits for flood control with a minimal impact on the anadromous fishery and other natural resources of the Cottonwood Basin. Contrary to the often held view of water developers and agricultural water users, the Sierra Club does not per se oppose all dams. Whenever, as in the present case of the Dutch Gulch and Tehama Dams, the flood control and water yield benefits outweigh minor encroachments on natural resources — then the Sierra Club can offer to support water development projects.

Much of the District's present concern for environmental protection springs from those days of the late sixties when General Fink (then Colonel) was Sacramento District Engineer. In a speech to the Audubon Society on 21 November 1969, he emphasized the role conservation groups could play in preauthorization planning of Corps projects. Reflecting the new spirit of cooperation between the Corps and conservation groups was an article in The Observer, a publication of the Sacramento Audubon Society, which noted the:



COLONEL JAMES C. DONOVAN, SACRAMENTO DISTRICT ENGINEER — 1970 — 1973

> . . .rapport developing between our Society and the . . . Corps has continued to expand with preliminary discussions regarding the Cache Creek Basin from Clear Lake through the Capay Valley to Woodland, and the Bear River drainage basin southeast of Marysville. We have been asked to review the ecological implications of proposed flood control projects.

Not long after he was appointed Division Engineer, Pacific Ocean Division, General Fink was awarded the Second Oak Leaf Cluster to his Legion of Merit in ceremonies at Fort Armstrong, Honolulu, Hawaii. While making the presentation, General Clarke, Chief of Engineers, remarked:

> Learning to live with ecology and conservationists is vitally important to the Corps. Colonel Fink contributed immeasurably to the public's understanding and appreciation of the Corps' role in ecology while he was Sacramento District Engineer . . .

On a national scale, General Clarke established a six-member Environmental Advisory Board in the spring of 1970. In announcing the formation of the board, the General stated that, "The Corps has recently taken a number of positive steps in organization, staffing, research and policy toward taking environmental considerations formally and fully into account in our activities." He went on to stress the important contribution the board could make toward mutual understanding and confidence between the Corps and both the general public and the conservation community.

In July 1970, OCE announced revisions to regulations pertaining to permits for work on navigable waterways. The changes required that greater emphasis be given to environmental values in evaluating permit applications. From that point on, evaluations would be based on such factors as conservation, aesthetics, water supply, flood damage prevention, fish and wildlife and "in general the needs and welfare of the people." The new directive reemphasized that the Corps was no longer concerned merely with the consequences to navigation.

Recently, Russell E. Train, Chairman of the President's Council on Environmental Quality, complimented the Corps by stating, "I would like to express our pleasure at the progress made by the Corps of Engineers in its responsiveness to the environmental goals being fostered by the Council."

Smog, urban sprawl, oil spills and a host of ill-conceived ventures have carried the "ecological crisis" into the awareness of most residents of the Sacramento District. Concerned legislators and citizens have responded by demands for clean air, pure water, and improvement in the quality of life in general. Some act from honest motives, while others cloak their selfish schemes in emotional but empty platitudes. There can be no doubt that industrial expansion, pollution and resource exploitation have extracted a heavy toll from the natural environment. In years past, the Corps of Engineers itself has been attacked and referred to as "The Diligent Destroyers."

Historically, no other single group has done more for the cause of conservation than the Corps of Engineers. An excellent example of this was (and is) their control of hydraulic mining in California. While other selfish interests raped the landscape and spoiled the streams, the Corps effectively controlled the former and cleaned up the latter. Before and since, it has been in the forefront of efforts to expand public concern for the environment. It seems reasonable to assume that the philosophy developed over the years, and so extensively implemented to date, will continue in the future.

Regardless of what the nature of new work, whether preventing floods, or planning urban renewal, the Corps in general and the Sacramento District specifically will not stray from the path nor fail to meet the high goals they have set for themselves.

COLONEL FREDERICK G. ROCKWELL, JR., SACRAMENTO DISTRICT ENGINEER, US ARMY CORPS OF ENGINEERS.

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Letters to the Author From:	**(Date Received)**
1. Barsdale, Ray (retired SPK)	December 1971
2. Coombs, James (retired SPK)	December 1971
3. English, Claude (retired SPK)	March/April 1972
4. Gomez, Amalio (retired SPK)	January 1972
5. Gorman, Clyde (retired SPK)	December 1971
6. Hazzard, Virgil W. — Deputy Base Civil Engineer - Travis A.F.B., Calif.	August 1971
7. Morley, Robert (Retired SPK)	February 1972
8. Morton, Marion (Retired SPK)	March 1972
9. Thompson, Ronald (Retired SPK)	December 1971
10. Rich, Henry (Retired SPK)	February 1972
11. Waddock, Frank L. (Retired SPK)	December 1971

Interviews:

Employees of the Sacramento District: U.S. Army Corps of Engineers.

1. Aicklen, Roan — Chief, Technical Engineering Branch
2. Donovan, Colonel James C. — District Engineer, October 1970 - July 1973.
3. Fink, Colonel George B. — District Engineer, January 1969 - October 1970.
4. Greenstein, Carl — Chief, Public Affairs Office.
5. Guthrie, Patrick — Chief, Geology and Concrete Section.
6. Henson, Lynn E. — Chief, Operations Branch.
7. Johnson, Oscar — Chief, Budget and Report Section, Military Design Branch.
8. Mathews, John — Chief, Management Branch.
9. Probasco, G.W. — Chief, Construction-Operations Division.
10. Rivera, George — Chief, Office of Administrative Services.
11. Ross, Jack — Chief, Planning and Control Branch.
12. Simmons, Robert — Outdoor Recreation Planner.
13. Weddell, George — Chief, Engineering Division.

Sacramento District Personnel: Retired

1. English, Claude
2. Gomez, Amalio
3. Gorman, Clyde
4. Hart, O. Haven
5. Kahiona, Sam
6. Kochis, Frank
7. McGee, Henderson
8. Rich, Henry

Other:

Davis, William N. — California State Archives Office.

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